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NETWORK CALCULATIONS.

One of the most tedious of electrical computations is the calculation of distributing networks, and therefore a method that will curtail the labor of such calculations is a real boon. Such a method is given on another page in an article by Mr. A. E. Kennelly, and having for its basis, moreover, a general proposition which appears to be distinctly new. This proposition is that a circuit represented by a triangle may be replaced for calculation by one represented by an equivalent Y, and vice versa, without disturbing in any manner the electrical distribution in the connecting external circuit. By the addition of a process given by the same writer in a recent issue (Aug. 19) the method may be made general in its application, extending to circuits containing e. m. f. and reactance, and thus will be of especial value in the solution of problems relating to delta and star connections in the three-phase system.

ON PARADE.

To stand up and be counted is essentially an American idea of gauging the extent of public support accorded to any policy, idea, man or thing; and the test usually works out in the shape of a parade. Judged in this way, the automobile is fast arriving, and the electric brand is particularly the one that is in front. Early last summer the first automobile parade in this country was held in New York City under the auspices of the National Electric Light Association, and it was a brilliant success. Last week the first decorated automobile parade in America was held at Newport, and once again a grand success was scored. We are glad to devote no small part of our space to it this week for the reason that it was like its predecessor practically an electrical affair. There seems to have been one gasoline carriage intended for the line, but it could not be started. The electrics, however, were covered with flowers and glory—and in America that means business.

ONE MILLION A DAY.

Less than four years ago, the export of manufactured goods from the United States was worth about half a million dollars a day. At the present time exports of manufactured articles are running not less than a million dollars per day, and there is no good reason for not expecting a steady increase in the amount, for while prices are going up the volume of business does not appear to diminish. On the contrary, it strikes deeper root, and branches out in new directions all the time, and the foreign technical press makes it a theme of constant comment.

Now that electrical manufacturing plants, under distinguished American auspices are multiplying abroad, it is possible that electrical exports may show a decline, but they do not, and the very fact of such important moves is an encouraging indication as to the trade that awaits the enterprising American whose foothold is here. The Treasury returns for July show an export of electrical machinery of $250,462 as compared with $161,481 in July, 1898, and for the seven months, a total of $1,598,039 as compared with $1,296,592 in the like period of 1898. These are gratifying figures, and are well supplemented by those of scientific instruments, telegraphs, telephones, lamps, etc. This group shows a total for July, 1899, of not less than $653,070 as compared with $240,005 in July, 1898, and for the seven

months not less than $3,140,325, or very nearly twice as much as in the seven months of 1898. In this data there is the best possible incentive for those who have determined to make their own the markets of the world.

Admirable Crichtons.

There was once a famous Scot who had so mastered all the science of his time that he was dubbed the Admirable Crichton. At other times, and in other days than this, such intellectual phenomena have been noted, but it has been doubted whether nowadays when specialization is called for, men of this type could be found. It would hardly be right to expect them to exist. In the earlier periods of electrical development also we had our Admirable Crichtons, too, and all-round men were not scarce in the field. Perhaps the late Frank Pope was the best example of them in this country as a thinker and writer, while Edison may be said to represent them as an inventor. But now it is very difficult, if not impossible, to find men really versed in all the branches. The best men are all specialists. It is true the old tradition of editorial omniscience still survives, but if all the electrical editors were to produce all the letters they get "calling them down," public opinion even on that point might change.

But now comes Mr. Morris W. Mead, at that interesting convention of the Municipal Electricians, and in his paper noted in our report he shows conclusively that the new up-to-date municipal electricians must be so erudite as to make even Lord Kelvin an ignoramus alongside of them. As the paper pointed out, even now the city electrician is overburdened with responsibilities, and in the near future he is in addition to all his present technical problems to have thrust on him the care and management of a municipal lighting system, a municipal street railway system, a municipal telephone exchange, and heaven knows what else. This may strike the casual reader as an exaggerated statement of the requirements, yet it is distinctly the programme of the municipalites, to be urged at Syracuse next week. We are sorry for the municipal electrician. He is going to be the most overburdened man of the next century.

The Drop of Voltage in Commutator Brushes.

The almost universal adoption of carbon or graphite brushes in place of the older metallic types during the last few years has been undoubtedly due to the reduced trouble from sparking, reduced necessity of accurate adjustment, the consequently reduced need of constant watching, and also the ability of the carbon brush to commutate at greater distances from the true plane of commutation, as well as to operate satisfactorily without readjustment under widely varying loads and field distortions. The well known reason for all these comparative merits of the carbon brush is its higher resistance and the gradual insertion of this considerable resistance into the path of the currents of short-circuited coils as the segments approach the edges of the brushes. The disadvantage of the carbon brush due to the same higher resistance has not prevented its adoption, although it has undoubtedly been the cause of the gradual increase of the length and diameter of commutators, due not so much to a need of more commutating surface as to give increased radiating surface for the heat generated.

There will be found on another page a description of recent tests of the contact resistance and friction of brushes under various conditions of current density and pressure. These tests coincide in the main, as closely as could be expected under the different circumstances of working, different materials, etc., with previous and now historic tests of many engineers, among them Mr. A. H. Moore, Mr. E. B. Raymond and Dr. E. Arnold. In some respects, however, they differ. Dr. Arnold's published results show that the resistance of copper gauze brushes remains practically constant under varying current densities, while those published herewith show a rise of resistance with reduced current similar to that of carbon brushes. This inverse ratio of the resistance of carbon brushes to the current density, making a plot of the two functions a more or less perfect rectangular hyperbola, leads to the interesting conclusion that the drop of voltage in the brushes of a machine is practically constant and independent of the current flowing. This drop is in low voltage machines a very serious one. Taking the curves given on another page, it amounts on an average to about eight-tenths of a volt. The curves given in previous papers on the subject confirm this, showing that the drop of voltage in the positive and negative brushes of a machine amounts to from 1½ to 2½ volts, which in the case of 125-volt machines, reduces the efficiency from 1½ to 2 per cent. The efficiencies of machines of higher voltages are, of course, affected to a smaller extent, and in any event the practical merits of carbon brushes will doubtless continue their popularity with dynamo operators.

Double Current Generators.

At the last convention of the National Electric Light Association there arose again like Banquo's ghost the old conundrum of "Which shall we use, direct or alternating current?" The manager of a prominent central station operating both alternating and direct systems—the result of a consolidation—called for light as to which to extend when adding new consumers, his alternating or his direct system. "Which," he asked, "will finally predominate, and to which can we tie for all services?"

In our issue of last week Mr. Alton D. Adams presented a forcible argument showing that for the present the average central station engineer cannot expect either system to take the place of both, and must do the best he can to provide economically both kinds of currents from his stations. Mr. Adams also pointed out the ameliorating circumstance, that single generators can now be built which will successfully deliver both alternating and direct currents. While this solution looks easy, and such generators are now at work in many places, the problem is by no means an easy one for the dynamo constructor, and unfortunately such double-current machines, as they have come to be called, are neither good direct current nor good alternating current dynamos.

The frequency which would be delivered by common continuous current machines built for direct coupling to engines, is only from 6 to 12 cycles per second, while the lowest frequency used in alternating current work is twice the latter figure. Ordinary 60-cycle alternators have much more crowded poles than have direct current machines, and far fewer slots per pole, generally three to nine. To make a single machine generate both kinds of current—or work as a rotary converter, which is exactly the same problem—a compromise has to be effected between the crowded poles of the alternator and the many slots per pole of the direct current machine. This compromise is generally accomplished by raising the peripheral speed which, as a rule, unfits the machine for direct coupling.

Naturally the problem is much worse in case alternating current is wanted at 60 cycles than when the frequency is only 25 cycles per second. Unfortunately, the former is the lowest frequency adapted for central station distribution and arc or incandescent lighting. The problem is also worse in the case of high voltages on the direct current side than in the case of low voltages, as the high voltages require more commutator segments and preferably more slots to go with them. Twenty-five-cycle, 125-volt or 250-volt machines are easy to construct; 60-cycle machines of the same pressures, or 25-cycle.

500-volt machines are comparatively difficult; while 60-cycle, 500-volt machines are pitifully fast running, crowded and screaming affairs; and efficient 125-cycle converters or double-current generators are still more difficult of achievement.

DEATH IN EXECUTION BY ELECTRICITY.

We have recently noticed in the daily press some assertions, stated to have been made by a representative of the Columbia University faculty, that the persons who are executed by electricity are not instantly killed, and are capable of resuscitation immediately after the shock. It is quite possible, of course, that this gentleman's views may have been misrepresented or exaggerated in the process of reduction to type; but the assertion deserves, we think, to be refuted. In its present form it resembles the statements made by the late eminent electro-physiologist D'Arsonval, who, however, went so far as to assert that in the case of electrically executed criminals death was effected by the knife of the surgeon during the subsequent autopsy.

We think that the error in both cases may have arisen from a too hasty generalization from special experimental observations. There is no evidence for impunging the experiments of D'Arsonval, and none that we know of for discrediting the reported experiments of Dr. Cunningham; but we believe that the alleged deductions from these experiments were too hasty. There can be no doubt from the results of extended experience, that persons may and do recover from severe electric shocks producing suspended animation, and that animals apparently killed by powerful electric currents or discharges are sometimes capable of resuscitation. It is also quite reasonable that some particular treatment or administrations may effect resuscitation in cases where ordinary means of treatment or administration will fail. What we wish to assert, however, is that electrical execution as effected in New York State produces instantaneous and painless death beyond every hope of resuscitation. If Dr. Cunningham has doubts upon this point, we would recommend him to attend an electrical execution in the capacity of a witness, and to be present at the autopsy. We venture to believe that his doubts will then disappear.

There are all kinds and degrees of electric shocks. There is the shock that titillates, the shock that stimulates, the shock that produces temporary local sensibility or analgesia, the shock that produces muscular contraction and the shock that alters or destroys living tissue. There are various kinds of shocks—those produced by continuous or alternating currents, those produced by prolonged currents or by brief impulses and oscillations. Consequently the physiological effects produced must depend in a large measure upon the precise electrical conditions, and no generalization is safely to be drawn from experiments conducted with one set of conditions to results attainable under very different conditions.

In the case of powerful alternating currents (upwards of 6 amperes) of frequency between 100 and 200 cycles per second, passed through the body of a criminal, and maintained for a number of successive seconds, there is not only exhaustion or destruction of tissues and functions, but there are also produced very powerful sustained general muscular contractions which seem to result in forcing the blood with such pressure into the cranial cavity as to produce effusions into the brain substance in many places; or a sort of generalized apoplexy. The lesions and cerebral hemorrhage thus produced appear to be such as might well defy all attempts at resuscitation or restoration of consciousness, even supposing that no other obstacle intervened. We may refer such of our readers as are interested in the subject to testimony in support of these views appearing in the ELECTRICAL WORLD for Feb. 16, 1895. The question as to whether capital punishment should or should not be inflicted, is a very wide one, upon which much difference of opinion exists, and it is outside the limits of the present discussion; but granted that capital punishment is necessary, we can unhesitatingly say, after personally attending executions by hanging, shooting, and electric shock, that the electrical method is the only one which is not revolting, and which with reasonable precautions is beyond all doubt certain, instantaneous and painless.

We think that there is no logic or sound basis for the belief that electricity in exacting the death penalty brings odium upon the use or distribution of electrical energy. We might with equal justice imagine that the hangman's unhappy task brought ropes into disrepute, or that the guillotine made the razor an object of execration. On the contrary, we think it is well that the public should know that electric shock, under special administration, can produce death. It is too late in the advance of civilization to fear that with wires overhead and underground in all directions, with telephones, telegraphs and electric light on every hand, that any panic is to be expected on the part of the public against the discriminate use of electrical appliances. Of all the agencies by which men develop and transmit power—heat, steam, gas, air, water and electricity—the last named seems to be the most readily safeguarded and controlled with a given reasonable expenditure of care.

ELECTRICAL JAPAN.

Our pages last summer contained a series of articles by Prof. F. B. Crocker on his observations made during a trip around the world, and particularly in the Far East. It was natural that China and Japan should arrest his attention and that in Japan he should find considerable electrical development. Those who were interested in his excellent letters will find the document on the commerce of Japan, just issued by the United States Treasury Department, a useful supplement to his shrewd comments as a scientific traveler. Statistics are given with liberality, rendering precise the more general statements that one expects in casual notes of passage; and at this juncture when Japan has entered for the first time the comity and sisterhood of nations, they are of great value as indicating how far advanced the empire is in all that marks and stands for civilization.

It is significant, for example, to note that the average number of telegraph messages already reached in 1897 no fewer than 305 per 1000 of the inhabitants. There are many European countries would think that creditable. In the United States we are not doing much better than 1000 messages per 1000 people, and Japan has come up to her present figure very swiftly. In other electrical indications she is also well up to the front. In the City of Tokyo, for instance, there are no fewer than 200 electroplating shops, at which in the aggregate a large amount of work is done. We are all aware how rapidly Japan has taken up telephony, electric lighting and electric railway work, and that she is now going in for power transmission. All things considered, Japan should be one of our best customers in the Far East for electrical apparatus, and the trade should be carefully cultivated and pushed. The Japanese want to manufacture for themselves, but if they have any outside preference it is most probably for American goods.

Incidentally it may be noted that Japan has recently established an Imperial Commercial Museum under the control of the Department of Commerce and Agriculture, and that it might be well to place electrical exhibits there. The new Japanese University founded with part of the Chinese war indemnity has also welcomed to its engineering museum a number of electrical samples, and it is obvious that no better plan could be devised of familiarizing the youthful engineers of Japan with our products so that they may ascertain their good qualities and specify them in future construction and installations.

Annual Meeting of the Edison Illuminating Association.

The fifteenth annual meeting of the Association of Edison Illuminating Companies convened at the Lafayette Hotel, Philadelphia, on Tuesday morning, the 12th instant. In the absence of the president, Mr. R. R. Bowker, of New York, Vice-President George R. Stetson, of New Bedford, presided. At the opening session the meeting listened to the report of the Lamp Testing Bureau for the year ending April 30, 1899; also to a paper on "The Renewal of Lamps," by Mr. F. W. Willcox, of the General Electric Company.

Mr. R. R. Bowker was elected an honorary member of the association. The following new members were elected: Edison Electric Company, Altoona, Pa.; Amsterdam Street Railway Company, Amsterdam, N. Y.; Edison Electric Illuminating Company, Baltimore, Md.; Chester Electric Light & Power Company, Chester, Pa.; Jackson Light, Heat & Power Company, Jackson, Mich.; Edison Electric Illuminating Company, Tamaqua, Pa.

Among those present were the following gentlemen: H. A. Wagner, St. Louis, Mo.; Joseph B. McCall, Philadelphia; G. Medici, Milan, Italy; J. T. Maxwell, Philadelphia; A. F. Walker, Grand Rapids, Mich.; E. D. Mullen, Philadelphia; Hoyt Post, Detroit; G. Semenza, Milan, Italy; Henry W. Darling, Des Moines, Ia.; J. H. Vail, Philadelphia; H. J. Hartman, Scranton, Pa.; T. E. Crossman, New York City; A. J. DeCamp, Philadelphia; J. M. Eglin, Philadelphia; W. J. Lockhart, Newark, N. J.; W. S. Barstow, Brooklyn, N. Y.; Edwin R. Weeks, Kansas City, Mo.; R. S. Hale, Boston; Louis A. Ferguson, Chicago; H. T. Edgar, Brockton, Mass.; J. W. Lieb, Jr., New York City; A. S. Knight, Boston; W. H. Atkins, Boston; W. H. Johnson, Philadelphia; C. R. Price, New Bedford; J. G. Rossman, Minneapolis, Minn.; J. W. Ellard, Baltimore; Leon H. Scherck, New Orleans; F. M. Noecker, Renova, Pa.; F. P. Spiese, Tamaqua, Pa.; H. C. Fogle, Canton, O.; W. J. Kehl, New Orleans; Fred M. Kimball, Boston; B. E. Sunny, Chicago; Charles T. Hughes, New York; E. H. Mullin, New York; George A. Redman, Rochester; F. W. Willcox, Schenectady; F. E. Barker, Boston; D. L. Huntington, Spokane, Wash.; W. S. Smith, Toledo; Alex. Dow, Detroit; Daniel McCoy, Grand Rapids, Mich.; Ch. Wustenfeld, Elgin, Ill.; A. W. Field, Columbus, O.; Charles F. Wallace, Brockton, Mass.; A. M. Robertson, Minneapolis; C. C. Perry, Indianapolis; William Chandler, Sault Ste. Marie, Mich.; C. L. Edgar, Boston; Luther Stieringer, Kansas City, Mo.; A. H. Manwaring, Philadelphia; John T. Gilchrist, Chicago; F. R. Jenkins, Chicago; E. B. Greene, Altoona, Pa.; George R. Stetson, New Bedford, Mass.; Wilson S. Howell, Newark, N. J.; H. G. Stott, Buffalo; Caryl D. Haskins, Schenectady; C. P. Steinmetz, Schenectady; Samuel Insull, Chicago.

As usual the convention has sat with closed doors, and the programme was not printed or given out officially.

In the afternoon the delegates and many ladies visited the battleships lying in the harbor, and Cramps' shipyards, taking carriages from the Hotel Lafayette headquarters to a special steamboat.

The meeting is one of the best attended that the association has had, the interest is well sustained, hospitality is abundant and the general success is marked.

Annual Meeting of the New York State Street Railway Association.

The annual meeting of this association was held at Ithaca on Sept. 12, when a large attendance was noted, and several good topics were admirably discussed. There were various social features and entertainments.

President G. Tracy Rogers in his annual address dwelt upon the advancement in every part of street railway development during the past year. He spoke of the use of compressed air as motive power in New York City, and the successful trial through the winter of the underground trolley system, which he thought the acme of street railway operations in large cities. He referred to the use of aluminum in place of copper as an electrical conductor as a possible relief for the embarrassment occasioned by the rapid increase in the cost of copper. He considered the success attending the alternating current as having largely contributed to the rapid development of interurban service. He pointed out that in many instances steam railways which were losing ventures had been made to pay handsome returns when thus electrically equipped.

He mentioned the decision in the Supreme Court of New York by Judge Marean that trolley roads in this state have the right to transport freight and express matter as of importance. He advocated a united effort on the part of the street railway men to secure an adequate compensation for carrying the United States mail. He gave figures to show that a large per cent. of the operating expenses went to labor, and reasoned that when earnings were reduced by a per cent. through hostile legislation or otherwise the natural result would be that employees would suffer a reduction in wages from 25 to 20 per cent. He believed that the public had been benefited through every consolidation of street railways, and that therefore the clamor against trusts should not apply to street railways.

He thought the bicycle would be continued as a convenience, but that its use as a pastime was on the wane. He thought, however, that the possibility of the automobiles' practicability in the line of cabs, omnibuses, etc., must be regarded by street railway men with attention, but without concern. He thought it had been demonstrated that it would be unwise to place the control of a city's transportation agencies in other than private hands, and stated that municipal ownership had received some severe blows of late. Referring to the Ford franchise bill, he said that street railway men generally thought any corporation using the municipal streets should pay a tax based on its earning power. He considered it a matter of congratulation that the Railway Commissioners of New York State were fair, able and painstaking.

National Export Exposition.

The National Export Exposition at Philadelphia will be opened at noon on Thursday of this week and remain open, Sundays excepted, until Nov. 30. The buildings have been completed at a cost of more than $1,000,000. The opening ceremonies will be attended by the governor of the state, the mayor of the city, and representatives of the United States Government and of many foreign nations.

The display of manufactured products is very extensive, and the methods of manufacture will be illustrated in many lines. The United States Government, in addition to a large appropriation toward the buildings, has expended $50,000 upon an exhibit.

The International Commercial Congress, which is to be opened in the exposition auditorium about the 10th of October, under the supervision of Director Wilson, will be attended by President Diaz, of Mexico. Thirty foreign governments and more than 125 foreign Chambers of Commerce have named delegates. The sessions of the congress will continue for about three weeks.

The Philadelphia "Avenue of Fame."

The Avenue of Fame, on Broad street, north and south of the City Hall, Philadelphia, erected in connection with the Grand Army of the Republic Encampment, held last week in that city, was probably the finest example of street decorative lighting ever seen in this country. The graceful columns of staff extended on both sides of the broad avenue from Cherry street on the north to Walnut street on the south, broken by the City Hall. The effect of the avenue was increased by the extensive illumination of that building. The sixty-two columns stood about fifty feet apart, the corner columns being fifty-five feet high and the intermediate posts forty-five feet in height. A line of bunting and laurel was swung between the columns and below this decoration was a festoon of thirty-four 16-cp lamps. The columns at each street corner were lighted by 154 and the intermediate columns by thirty-four 16-cp lamps. The lighting of the columns was judiciously arranged and brought out the cornices and capitals, at the same time throwing a strong light on the bunting and flags.

The current for the columns and flags was supplied by the Edison Electric Light Company, and the 6000 16-cp lamps were installed by the Sawyer Electrical Company, who were the contractors for similar work on the Court of Honor at the Peace Jubilee in 1898.

This company deserved the highest praise for the manner in which they performed their work, as it was completed promptly and the illumination was perfect on the opening night. Mr. A. A. Lowry, treasurer of the Sawyer Company, stated that the avenue would not only be lighted for the entire week ending September 9, from 7 to 12 o'clock, but that the city authorities were arranging to maintain the work until after the opening of the Export Exposition, September 14, so satisfactory was the result.

Canadian Water Power Electrical Plants—IX.

TWO-PHASE WATER POWER DEVELOPMENT AT SHERBROOKE, QUEBEC.

By E. M. ARCHIBALD.

THE Magog River, its source in Lake Memphremagog, some thirty miles in length and situated high up in the Green Mountains of Vermont, flows in a northeasterly direction crossing the border between the United States and Canada, finally joining the St. Francis River, one of the numerous tributaries of the St. Lawrence. At the junction of the two rivers Sherbrooke, a city of 12,000 inhabitants, is prettily situated, lying on the banks of both the Magog and the St. Francis Rivers.

Within half a mile of this junction there is a gradual fall of 110 feet in the Magog, and as there is a plentiful supply of water throughout the entire year, this convenient and economical power is utilized to a great extent in supplying many industries, of which the principal are woolen, grist and saw mills, iron works, a carpet factory, the water works and the street railway and electric light plants. Though the head obtainable for each mill varies to a large extent, yet the average is about 24 feet.

Though it might be profitable from an hydraulic standpoint to investigate the methods employed by the various mills to develop the water power, we must content ourselves with a brief description of the electric light and power plant, its power development, its equipment and distribution.

This electric light plant, as it is still called, was installed in 1889 by the Sherbrooke Gas & Water Company, which at that time operated both the gas and water works, as it name implies, but which has since disposed of the latter to the city, still retaining the gas works together with the electric plant. Here we find one of those rare cases where the gas and electrical interests do not conflict. In all the latest buildings being constructed the electric light is installed to the exclusion of gas, which is now, however, much used for heating purposes, taking to a great extent the place formerly occupied by the coal stove.

Since its inception the electric plant has undergone many changes. It first started with but a few lights run on the single-phase alternating current system. After increasing in common with all other similar plants, machine after machine being added when necessary, a radical change was made in 1897 by the adoption of the two-phase system using S. K. C. machines, which have been in operation ever since for both light and power with excellent results.

FIG. 1.—SHERBROOKE POWER HOUSE.

WATER POWER DEVELOPMENT.

One of the numerous small falls on the Magog has been utilized as a head for the power required. By reason of a natural dam extending across the river at this point between the two rocky cliffs composing the river banks, but a comparatively small outlay was necessary to control, store and utilize the otherwise wasted potential energy of the water.

The river flows through a narrow rocky gorge some 200 feet

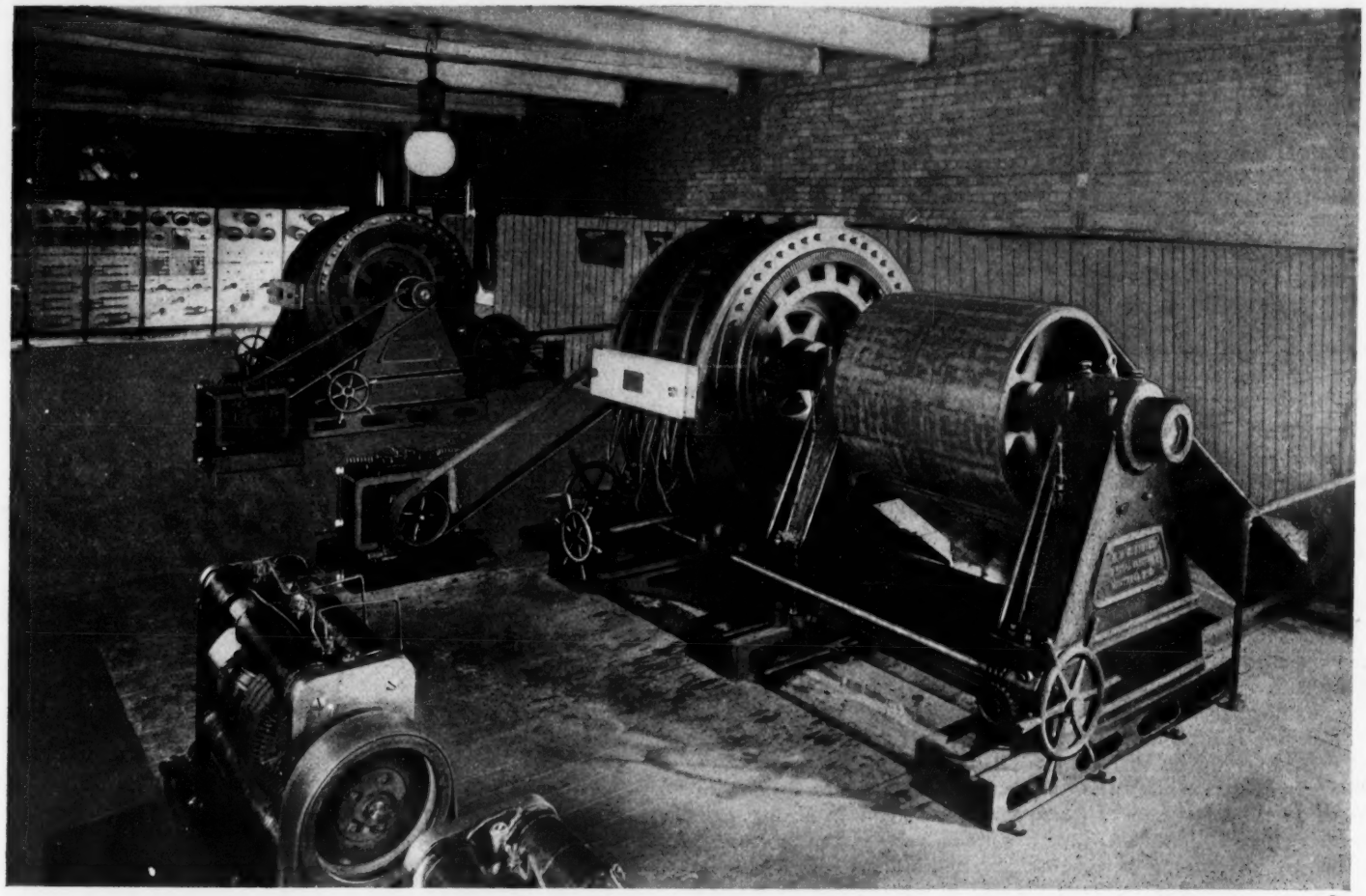


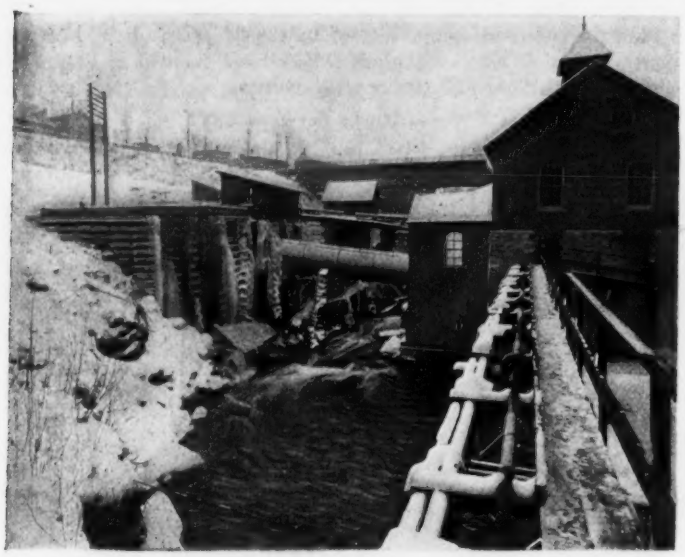
FIG. 2.—INTERIOR OF POWER HOUSE.

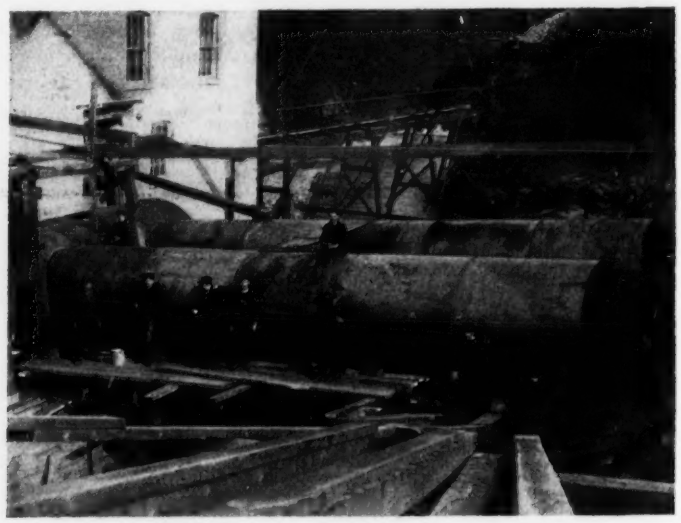
wide, the sides rising very abruptly, almost precipitously, from the river bed, which is nothing but solid rock. The natural rock dam extended almost entirely across the river at the point selected for the head race entrance, and all that was required was to erect a wing dam and thus direct the flow of the water and also to store it.

The inner side of the head race is the abrupt bank of the stream, some blasting being necessary for the removal of the projections and the large boulders to make it conform to the required conditions for service. The outer side is constructed entirely of timber, the main supports being 10-inch by 10-inch spruce faced with 3-inch plank on the inner side, which slopes diagonally into the head race such that the weight of the water itself provides the required stability. The form of this retaining wall is thus a right-angle triangle, the vertical side varying in height from 8 feet at the entrance to 30 feet at the extreme end of the head race, while the base varies correspondingly.

The head race is 300 feet long and varies in width from 50 feet at the bulkheads to 150 feet at the entrance, the breadth of the river; in depth it is 5 feet at the entrance, increasing somewhat as the bulkheads at the far end are reached.

The velocity of water in the head race is 4 feet per second, and it is consequently never frozen over even during the most severe weather in winter. Strange to relate, no great difficulty has been experienced with either frazil or anchor ice, never yet necessitating the shutting down of the plant for a moment. There is, of course, a certain amount of frazil at times, as in all running water exposed to intense cold, but not enough to do any damage, and during severe weather men are always stationed at the two racks to prevent the accumulation of ice, slush or rubbish, which they remove with rakes through small waste gates in the sides of the head race or over the sloping sides. There are two racks placed 100 feet apart in the head race to prevent ice of any description, logs or floating débris passing through to the wheels.





Figs. 4 and 5.—View of Tail Race and Flumes.

Situated at the lower end of the head race are two gate houses serving as intakes or entrances to the three pipes or flumes carrying the water to their respective turbines in the power house. In each gate house there are wooden gates which may be closed when necessary to stop the flow of water in the flumes.

The first flume is a ¼-inch steel pipe 6 feet 6 inches in diameter composed of 6-foot lengths securely riveted together; the whole flume from gate house, where there is a one-eighth turn elbow located, to the wheel case, to which it is riveted, is 50 feet long. The remaining two flumes are also of ¼-inch steel, 6 feet 8 inches in diameter, 50 feet long, running side by side in a straight line to the wheel case situated in the power house. A view of this when under construction being shown in Fig. 4. The weight of these massive pipes is supported by two large masonry piers in which they are embedded to about one-quarter of their diameter. Expansion or contraction is neglected, as it is inconsiderable in such a short length of pipe, besides which the water inside is flowing continually and the heating or cooling effect of the atmosphere on the pipe is thus reduced to a minimum.

TAIL RACE.

The tail race, a great portion of which has been blasted out of the solid rock, is directly beneath the bulkhead, and lying between it and the power house. A winter view of this and also the bulkhead and pipe line is shown in Fig. 5. It is 140 feet long and 40 feet wide, the discharge flowing away into the river, where it undergoes a similar process farther down, being utilized again and again for power purposes.

A wing dam constructed of rock and of the shale removed during the process of blasting separates the tail race from the river, and is 5 feet higher than the level of the tail race, thus preventing its being submerged by the river even at high water.

The draft tube, 7 feet in diameter at the top, extends down vertically a few feet from the large wheel case, then gradually making a quarter turn, discharges into the tail race in the direction of flow, its diameter here being increased to 10 feet. A deep hole was excavated in the tail race to accommodate this huge pipe, keeping it continually submerged so that no air could possibly enter to destroy the head produced by the vacuum due to the rapidly descending discharge water. The greatest available head is 34 feet, which is one very desirable for facility and economy of operation.

POWER HOUSE.

Nestling in the chasm between the precipitous banks of the river is a small rocky island, and here is the location of the power house, a one-story brick building 80 feet long by 26 feet wide. (Fig. 4.) The foundations are of solid masonry resting on the bedrock.

The framework is of wood, the timbers being very massive; the floors are of very thick hardwood planking supported by wooden beams; the roof is also of planking, but is covered with iron sheathing.

The hydraulic equipment consists of three turbines having a total capacity of 1730-hp. The first is a 54-inch "New American" vertical turbine capable of developing 535-hp at 124 r. p. m. under the normal head of 30 feet obtained at this point; this head may be increased at any time by carrying the tail race excavations further up, and so obtaining almost the whole 34 feet which is used at the other wheels only some twenty feet away. This wheel was manufactured and supplied by Wm. Kennedy & Sons, Owen Sound, Ont., the Canadian agents and manufacturers for the Dayton Globe Iron Works Company, of Dayton, Ohio. From a horizontal pulley connected to the vertical turbine shaft by means of mortise bevel gearing, a generator in the dynamo room is belted.

The remaining two are each 40-inch "Crocker" wheels of the horizontal type, both placed in one case, a huge steel cylinder, 10 feet in diameter and 22 feet long, fed by the two steel flumes (Fig. 2). Being inward flow turbines, the water enters at each end of the case, and rushing inwards towards the centre, strikes the wheel vanes, the thrust of each wheel being equalized by the other; being then deprived of its energy the water falls inert into the draft tube and descending vertically, discharges into the tail race. This draft tube has a vertical height of 17 feet above the tail race and the head over the wheels is also 17 feet, thus producing an available head of 34 feet, at which each wheel is capable of developing 596-hp at 180 r. p. m. Two overhung pulleys, one at each end of the wheel case, supply power to two generators in the dynamo room by means of two immense leather belts; an adjustable belt tightener is used to take

up all slack. A plan and elevation of the power house (Fig. 3) will show the above arrangement. The two "Crocker" wheels, with wheel case, steel flumes and draft tubes were manufactured and installed by Jenckes Machine Company, of Sherbrooke, Quebec.

The gates on all three wheels are of the "register" type which, on opening or closing by some regulating device, control and adjust the quantity of water striking the vanes of each wheel. The regulating device by means of which the gates are opened or closed according to the variation in the speed of the generator, is a "Replogle" electro-mechanical governor, manufactured at the Replogle Governor Works, Akron, O. There are two of these governors, one for each water wheel unit—one for the "New American" and the other for the two "Crocker" wheels, the gates of both wheels being operated to the same degree at the same instant, as both are in the same wheel case.

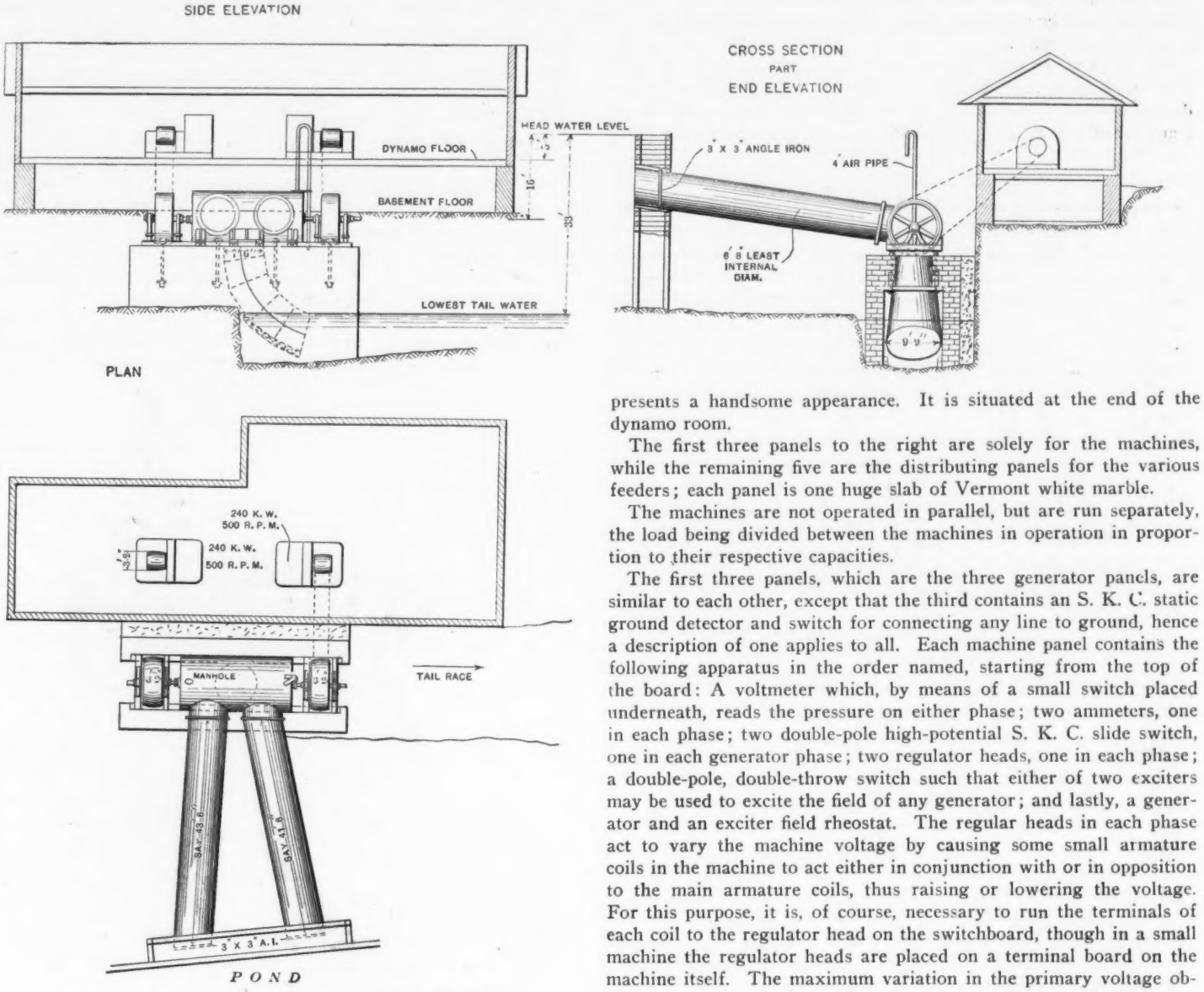


FIG. 3.—PLAN, ELEVATION AND SECTION OF POWER HOUSE.

The electrical equipment consists of two 240-kw two-phase S. K. C. generators belted to the "Crocker" unit, one 180-kw two-phase S. K. C. generator and three 35-light "Ball" arc machines all belted to the "New American" wheel.

The two largest machines (Fig. 2) are placed on concrete foundations 10 feet high resting on the bed rock beneath, and operate at 500 r. p. m., delivering current at a pressure of 2400 volts direct to the line with a frequency of 133 cycles per second. The 180-kw two-phase generator has the same voltage and frequency, but is run slightly faster—at 660 r. p. m.

Belted to the shaft of each of the three generators is an 8-kw 4-pole exciter, each of which is capable of fully exciting the entire plant.

All the S. K. C. apparatus, generators, switchboard and instruments were manufactured and installed by the Royal Electric Company, of Montreal.

There are three 35-light arc machines, made by the Ball Electric Company, of Toronto, in use at present, but these will shortly be shut down and the present system of direct current series arc lighting changed to the enclosed alternating current arc lamp system run from constant current transformers, so that power, incandescent and street lighting will all be operated from one machine, thus making an ideal arrangement.

SWITCHBOARD.

The switchboard, a view of which may be seen in Fig. 2, consists of eight white marble panels mounted on a solid white oak frame, presents a handsome appearance. It is situated at the end of the dynamo room.

The first three panels to the right are solely for the machines, while the remaining five are the distributing panels for the various feeders; each panel is one huge slab of Vermont white marble.

The machines are not operated in parallel, but are run separately, the load being divided between the machines in operation in proportion to their respective capacities.

The first three panels, which are the three generator panels, are similar to each other, except that the third contains an S. K. C. static ground detector and switch for connecting any line to ground, hence a description of one applies to all. Each machine panel contains the following apparatus in the order named, starting from the top of the board: A voltmeter which, by means of a small switch placed underneath, reads the pressure on either phase; two ammeters, one in each phase; two double-pole high-potential S. K. C. slide switch, one in each generator phase; two regulator heads, one in each phase; a double-pole, double-throw switch such that either of two exciters may be used to excite the field of any generator; and lastly, a generator and an exciter field rheostat. The regular heads in each phase act to vary the machine voltage by causing some small armature coils in the machine to act either in conjunction with or in opposition to the main armature coils, thus raising or lowering the voltage. For this purpose, it is, of course, necessary to run the terminals of each coil to the regulator head on the switchboard, though in a small machine the regulator heads are placed on a terminal board on the machine itself. The maximum variation in the primary voltage obtained by means of this regulator head is 200 volts on each phase.

Each of the five feeder panels is but a repetition of the other, so that a description of one will suffice. The first two panels are for the incandescent lighting circuits only, while the remaining three panels are for combined light and power from the three-wire two-phase distribution used. Each of these panels, then, contains the following apparatus, ziz: Two ammeters, one in each phase or circuit; two S. K. C. circuit breakers, also one in each phase, and four double-pole double-throw switches such that any circuit on the lighting panels may be placed in either phase of either generator.

The indicating instruments are mostly of the Royal Electric Company's round type, though some few of the Whitney make are observed.

DISTRIBUTION.

From the switchboard the various feeders pass through two cupolas in the roof to the poles, where current is then distributed in the city on the three-wire two-phase primary system, and transformed down to 104 volts for light and power service by means of transformers banked in as large units as may be economically used to supply all the customers in that immediate vicinity. The ordinary four-wire two-phase secondary distribution is used exclusively.

Though no lightning arresters nor choke coils are placed in the power house, there are no less than twenty sets of two S. K. C. non-arcing lightning arresters located at various points on the line, to which taps from the service wires are taken, the ground wire being No. 4 B. & S. As an extra precaution, a barbed wire is run along the top of the poles and grounded at every fifth pole in one section of the city.

There is a short transmission line to Lennoxville, a town of some 2000 inhabitants, situated four miles away, where both light and power are supplied.

The poles for this line are similar to those used in the city, perhaps somewhat shorter, and are of white cedar, 35 feet long, 7 inches in diameter at the top, embedded 5 feet in the ground, and are spaced 100 feet apart.

The three-wire two-phase line consists of two No. 2 B. & S. and one No. 1 B. & S. weatherproof insulated copper wires placed on double petticoat glass insulators, thirteen inches between wires. A transformer is used as a booster to raise the potential on this line a

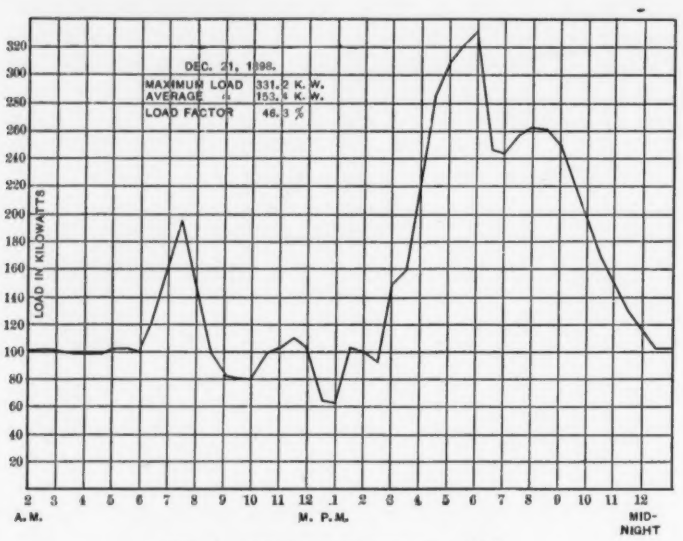


FIG. 6.—LOAD CURVE, DEC. 21, 1898.

slight amount, such that the voltage at Lennoxville will be the same as in the city; that is, the amount boosted will represent the line drop, which is in this case a very small amount.

This plant is in operation continually, suffering no interruptions. A load curve is shown in Fig. 6. There are some 6500 16-cp incandescent lamps and about 150-hp in induction motors in various sizes installed, and, as previously stated, by the time this goes to print there will be a system of 100 enclosed alternating current arc lamps of the General Electric type for street lighting, supplied from the regular circuits by means of constant current transformers.

Current is sold both by meter and by the flat rate, some 300 meters being already installed. For incandescent lighting the rate is one-half cent per ampere-hour after deducting the usual discount allowed for prompt payment, a 3½-watt lamp being used. The flat rate is $6 per 16-cp lamp per year, with a sliding scale of prices for large consumers. For power the rate varies from $70 per hp-year in small units to $30 per hp-year for larger sizes, such as 30-hp and greater.

The officers of the Sherbrooke Gas & Water Company are: Mr. R. W. Heneker, president; Mr. E. F. Waterhouse, secretary, and Mr. A. Sangster, electrical engineer and general superintendent.

Telephony in Mid-Africa.

An English expedition which left the Gulf of Aden in November for exploration in Abyssinia, has just returned to England from Cairo. Its route lay through Somaliland to Harar, and from thence to Adis Abeba, the Abyssinian capital. The only sign of civilization was the telephone running between these two places, a distance of about 300 miles. The stations, which are about two days' march apart, are mere thatched huts surrounded by strong high stockades. The dirty Eastern hut, with its Abyssinian attendant, affords a striking contrast with the telephone and the instructions to "Ring up Adis Abeba." The line was constructed by a Franco-Russian company in which King Menelek, of Abyssinia, is a shareholder.

A New Type of French Automobile Hansom.

The accompanying illustration shows a new type of automobile which attracted considerable attention at the recent automobile Exposition in Paris. It will be noticed that an attempt has been made to depart from the usual design of automobiles, which has as a rule heretofore merely followed that of horse vehicles. The carriage was exhibited by Captain Draullette. As will be seen, the seat of the driver is in the rear, and passengers mount from in front between the two steering wheels. The seat is semi-circular in shape, which allows four people to be seated with the slightest inconvenience to each other. The steering wheels are 30 inches in diameter, and the driving wheels 42 inches in diameter. Solid rubber tires are used. The frame, which is of steel and U-shaped, is supported by springs forward, and rests directly on the rear axle, where it contributes to support the mechanism.

A bipolar series motor is employed, with double armature winding and two commutators, and with two-field windings. The different speeds are obtained by various connections of these four windings. The motor is pivoted on the axle and supported in the rear by a spring. A leather pinion on the motor shaft engages with a differential gear and motion is communicated to the wheels through an intermediate shaft, and two pinions engaging directly with a gear wheel with interior teeth, secured to the spokes of the driving wheels. The ratio of reduction is 26 in all.

The controller, placed in front of the seat, is extremely simple. It comprises essentially an insulating cylinder on which are secured copper contact pieces; a disk with an indicating hand and a con-

NEW TYPE OF FRENCH ELECTRIC HANSOM.

troller wheel. The cylinder moves around a fixed steel tube, through the interior of which passes the steering shaft.

The different speeds are obtained in the following manner. For the first speed the four motor windings are in series together with a starting rheostat; for the second speed the same connection, but without the rheostat; for the third speed, the two armature windings are in series and the two-field windings in parallel; for the fourth speed, all the windings are in parallel. In backing, the connections are as for the first speed ahead, but the current is reversed.

The electrical braking arrangement does not permit the return of power to the batteries, and it is not applied until after the interruption of the running current. In the first braking movement, one of the field windings is suppressed, and the current from the two armature windings passes through the resistance of the second field winding. In the second movement, the two field windings are in series with each other and with the armature windings, the

resistance of the circuit being thus augmented. In the third movement, one of the armature windings is in circuit with one field winding, and the other armature winding in circuit with the second field winding, which also has the rheostat in circuit. In the fourth movement the two armature windings are separately in circuit with the field windings.

The electric brake is not necessarily employed alone to stop the carriage. By means of a new arrangement special in this carriage, when the mechanical brakes are applied, the electrical brake circuit is automatically thrown in. In addition, the combination is such that the electrical brakeage becomes the more powerful as one bears more strongly on the brake pedal; the mechanical brakeage being thus also increased. It will thus be seen that the two braking arrangements being independent, if one does not act, the other will still be in service. The usual switch for breaking the circuit is not used; when the pedal is manipulated, the controller automatically comes to zero, then passes to the braking position. This disposition has an additional advantage of avoiding incorrect manipulations such as may occur when, going at high speed, the current is stopped by applying suddenly the mechanical brake. In this case if the driver forgets and leaves the controller at the position of higher speed, and takes his foot away from the brake pedal, a serious accident is inevitable.

The combination of the mechanical brake and the controller is such that by working the controller wheel, the electric brake can be operated without operating the mechanical brake. This disposition is utilized with much advantage on down grades, and owing to the several progressive values of the electric brake, the carriage can be permitted to descend at a convenient speed, which will be automatically maintained at a fixed value, there being thus no necessity to apply the mechanical brake.

Steering is controlled by means of an arm which actuates a shaft passing through a tube forming the axis of the controller. This shaft has at its lower portion a toothed wheel which, by means of a chain, turns a second toothed wheel situated on the forward axle. The ratio between the two pinions is 2.75 to 1.

The carriage carries 44 storage batteries, weighing 770 pounds, and gives a capacity of 105 ampere hours at a discharge rate of 21 amperes. The battery is placed under the seat, half to the right and half to the left. The carriage with its load of passengers weighs 2640 pounds.

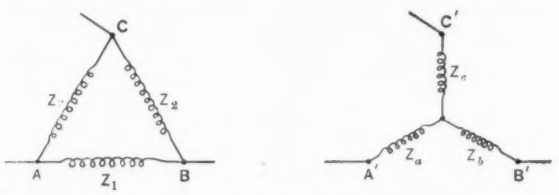
The Equivalence of Triangles and Three-Pointed Stars in Conducting Networks.

BY A. E. KENNELLY.

Computations relating to conducting networks are often capable of being simplified by the use of the following proposition, which seems to be new:

To every triangle there corresponds a Y, which is its external equivalent, so that one may always be replaced by the other, without disturbing the electrical distribution external to it.

Thus the triangle of impedances z_1, z_2, z_3, connected between the

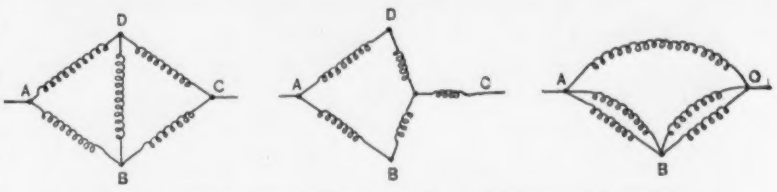


FIGS. 1 AND 2.—STANDARD TRIANGLE AND "Y."

points *A*, *B*, *C* (Fig. 1), is equivalent to the *Y* of impedances z_a, z_b, z_c (Fig. 2), connected between the same three points, provided that a certain quantitative relation holds between the *Y* impedances and the Δ impedances.

Consequently, in dealing with a network of conductors, we may always replace a Δ by its equivalent *Y*, or a *Y* by its equivalent Δ, without altering the external distribution. In this manner a network may sometimes be simplified.

Suppose, for example, that it is required to know the impedance offered by the Wheatstone Bridge *ABCD* (Fig. 3), between the terminals *A* and *C*. The computation is quite complex and tedious if the bridge is in the unbalanced condition, and the formula is not likely to be remembered; but if we replace the triangle *BCD* by its equivalent *Y*, as in Fig. 4; or, if we replace the *Y*, *DA*, *DB*, *DC* by



FIGS. 3, 4 AND 5.—TRANSFORMATIONS OF WHEATSTONE BRIDGE.

its equivalent triangle as in Fig. 5, the computation of the impedance between *A* and *C* becomes simple.

The formula for determining the impedance of any *Y* branch in terms of the sides of its corresponding triangle is:

$$z_a = \frac{z_1 z_2}{z_1 + z_2 + z_3} \quad \text{ohms} \quad \ldots\ldots\ldots\ldots (1)$$

and symmetrically corresponding formula for z_b and z_c. The rule is easily remembered as follows:

The impedance of a Y-branch lying between, or replacing, a pair of delta-sides, is equal to the product of the impedances of those sides, divided by the impedance of the delta, considered as a simple closed circuit.

The corresponding formula for determining the impedance of any delta-side in terms of its corresponding *Y* branches is best expressed in terms of admittances instead of impedances. Let $y = \frac{1}{z}$. Then

$$y_1 = \frac{y_a y_b}{y_a + y_b + y_c} \quad \text{mhos} \quad \ldots\ldots\ldots\ldots (2)$$

with symmetrically corresponding formulas for y_2 and y_3. The rule is easily remembered as follows:

The admittance of a delta-side corresponding to, or replacing, any two Y-branches, is equal to the product of the admittances of those branches, divided by the sum of the admittances of all three branches.

As an example, if a delta, or triangle, has sides:

$z_1 = 1$ ohm; $z_2 = 2$ ohms; $z_3 = 3$ ohms.

Then the branches of the corresponding or equivalent *Y* are, by formula (1)

$$z_a = \frac{1 \times 3}{1 + 2 + 3} = 0.5 \text{ ohm},$$

$$z_b = \frac{1 \times 2}{1 + 2 + 3} = 0.\dot{3} \text{ ohm},$$

$$z_c = \frac{2 \times 3}{1 + 2 + 3} = 1 \text{ ohm}.$$

Similarly, taking the branches of a *Y* as

$z_a = \frac{1}{2}$ ohm, $z_b = \frac{1}{3}$ ohm, $z_c = 1$ ohm,

the admittances of these branches are

$y_a = 2$ mhos, $y_b = 3$ mhos, $y_c = 1$ mho,

and the admittances of the sides of the corresponding or equivalent delta are, by formula (2)

$$y_1 = \frac{2 \times 3}{1 + 2 + 3} = 1 \text{ mho}, \quad \therefore \quad z_1 = 1 \text{ ohm},$$

$$y_2 = \frac{3 \times 1}{1 + 2 + 3} = \frac{1}{2} \text{ mho}, \quad z_2 = 2 \text{ ohms},$$

$$y_3 = \frac{2 \times 1}{1 + 2 + 3} = \frac{1}{3} \text{ mho}, \quad z_3 = 3 \text{ ohms}.$$

We have hitherto assumed the Δ or *Y* to be devoid of resident e. m. f. The effect of resident e. m. f. is, however, readily introduced into the transformation.

Suppose a delta, in the sides of which are resident known electromotive forces, direct, alternating, or polyphase. To transform this delta into its externally equivalent *Y*, first determine the impedances of the corresponding *Y* branches, by formula (1), as if no e. m. f. were present. It is now required to find the magnitudes of the e. m. f.'s, which must be inserted in the *Y*-branches in order that the *Y* thus energized shall be externally equivalent in all respects to the original delta. Draw the vector e. m. f. diagram of the delta, and apply at its corners imaginary masses equal to the admittances of the corresponding *Y*-branches. Find the centre of gravity of the loaded triangle, and connect it with the corners by straight lines.* These

*See a paper "On The Determination of Current Strength in Three-Pointed Star Resistance Systems," page 268, Vol. 34, No. 8, Aug. 19, 1899. El. World and Engineer.

lines represent respectively the e. m. f.'s to be inserted in the branches of the *Y*.

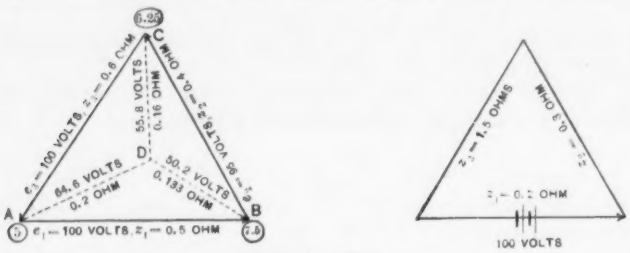
As an example, consider a delta of sides: $z_1 = 0.5$ ohm; $z_2 = 0.4$ ohm; $z_3 = 0.6$ ohm with polyphase e. m. fs. inserted in them.

$e_1 = 100$ volts; $e_2 = 95 \angle 118°.21'$ volts; $e_3 = 100 \angle 123°.18'$ volts.

To transform this delta into its equivalent *Y*, we find by formula (1) the impedances of the *Y*-branches:

$z_a = 0.2$ ohm, $y_a = 5$ mhos,
$z_b = 0.1333$ ohm, $y_b = 7.5$ mhos,
$z_c = 0.16$ ohm, $y_c = 6.25$ mhos.

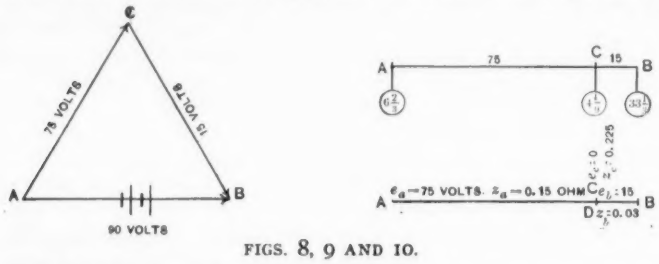
Fig. 6 now shows the delta vector diagram *ABC* with loads of 5, 7.5 and 6.25 mhos applied to the corners. The point *D* is the centre of gravity of these three loads, according to the well known rules of statics. The dotted lines *DA, DB, DC* represent, to scale, the magnitudes and phase relations of the e. m. f.'s resident in the branches of the equivalent *Y*.



FIGS. 6 AND 7.

The impedances z_1, z_2, z_3 assumed in this example are reactanceless. If reactances are present, the same rule is followed. The corner loads are then complex quantities, and the ordinary formulæ for determining the centre of gravity of the triangle must be extended to include complex masses, without any formal modification. In other words the same formulæ are used, but the terms and results are interpreted vectorially.

As a final example, consider the direct-current triangle represented in Fig. 7. Here $z_1 = 0.2$ ohm; $z_2 = 0.3$ ohm; $z_3 = 1.5$ ohm; $e_1 = 100$ volts. To find the equivalent *Y* we obtain from formula (1) $z_a = 0.15$ ohm; $z_b = 0.03$ ohm; $z_c = 0.225$ ohm; and hence $y_a = 6.667$ mhos; $y_b = 33.33$ mhos; $y_c = 4.444$ mhos. In the triangle, a direct current of 50 amperes circulates, and establishes the potential differences indicated in Fig. 8; namely, $e_1 = 90$ volts; $e_2 = -15$ volts; $e_3 = -75$ volts. If we draw the vector diagram of this triangle, we obtain the straight lines *AB, AC, BC* of Fig. 9, and by attaching to the points *A B* and *C* of this line the imaginary masses, 6 2-3 mhos, 33 1-3 mhos, and 4 4-9 mhos respectively, we find that the centre of gravity of the loaded line lies at the point *C*, which corresponds to the central point *D* of Fig. 6. This gives the three branch lines *DA, DB* and *DC* as in Fig. 10, with the remark that *DC* is indefinitely short, so that $e_a = AD = -75$ volts, $e_b = DB = 15$ volts; $e_c = DC = 0$ volts; and this gives the conventional *Y* of Fig. 11 with its respective e. m. f.'s and resistances. Any distribution of pressures, currents, or activities in a conducting system embracing the triangle of Fig. 8 will be exactly the same if the triangle be replaced by the *Y* of Fig. 11, except in so far as relates to currents, pressures, or powers *within* the triangle or *Y*.



FIGS. 8, 9 AND 10.

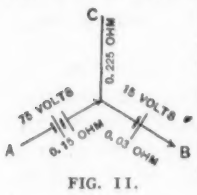


FIG. 11.

The rule is of useful application in three-phase systems with delta and *Y* terminal connections.

THE ELECTRIC DROSCHKES on the Berlin streets have been a great success, the new motor-cars completely distancing the old "hippomobiles," as a witty Frenchman described a cab, in the favor of the public. During the coming automobile exhibition a special cab stand will be reserved for the motor droschkes.

The Automobile Parade at Newport, R. I.

BY SPENCER C. CRANE.

WHEN it is stated that the greatest fashionable hit of the Newport year was the floral automobile parade, it will convey to those who know that swell seaside resort on the Rhode Island coast some idea of the exquisite beauty and originality shown by the decorators of the carriages. Cost seemed to be a secondary affair, and in most cases was not considered at all. The expense of decorations ran all the way from seventy-five to three or more hundred dollars. The materials and designs consisted principally of flowers, ribbons and miniature electric lights fed from the storage batteries which propelled the carriage. White and light blue were the prevailing colors, though one carriage was decorated with straw and red poppies. In some cases Chinese lanterns, doves and eagles were added, which greatly enhanced the general effect.

At four o'clock on the afternoon of Sept. 7 there did not appear to be an automobile stirring in all Newport, but at the various florists they were to be found being decorated, and dozens of deft hands there were hurriedly putting on the finishing touches. No more beautiful sight could be imagined than the brilliant costumes of the élite of Newport at Hodgson's, on Bellevue Avenue, blended with the profusion of flowers on the ground and those on the "autos."

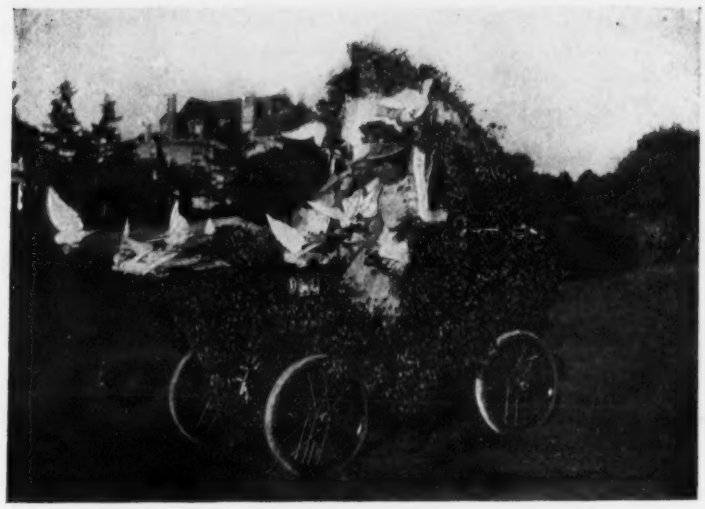
At 4:30 the automobiles seemed to be coming from every direction, like pure frosted snow carriages, and filled with merry riders. At 4:45 all the carriages were drawn up in line at the entrance of the tournament grounds at Belcourt, where Mr. O. H. P. Belmont had laid out a serpentine course, marked by poles decorated with garlands of flowers. A portion of the course was laid out between obstacles such as stuffed men and women, policemen and stuffed horses hitched to fine victorias, in which were seated footmen and grooms. It was sometime before it was discovered that the grooms and footmen were alive. The tests of the course were for skill in handling the automobiles between narrow places, in turning, in speed and in form. Unfortunately, the first of the participants attempted a right-angle curve on the grass where the wheels could not slip, at a speed of nearly twenty miles an hour, with the result of dishing three of the wheels. This led to a diminished speed being allowed or required at this point. With the exception of this accident, in which no one was hurt, the electrics made the course without mishap. While the electrics were one after another completing the difficult task, the owner of a gasoline machine was working with desperate zeal to start his motor. The gentleman was forced to discard his regulation automobile rig of hat, coat, vest and glasses in consecutive order in his unsuccessful attempt.

Mr. W. K. Vanderbilt, Jr., won the first prize for speed with a steam carriage geared to forty miles an hour, while Mrs. Herman Oelrichs received the first prize for decorations, and Mr. M. M. Shoemaker second. The first prize for competition driving was awarded to Mr. Stuyvesant L. LeRoy. As many of the operators of the electric carriages were ladies, it speaks well for the simplicity of the manœuvring mechanism of the electrics.

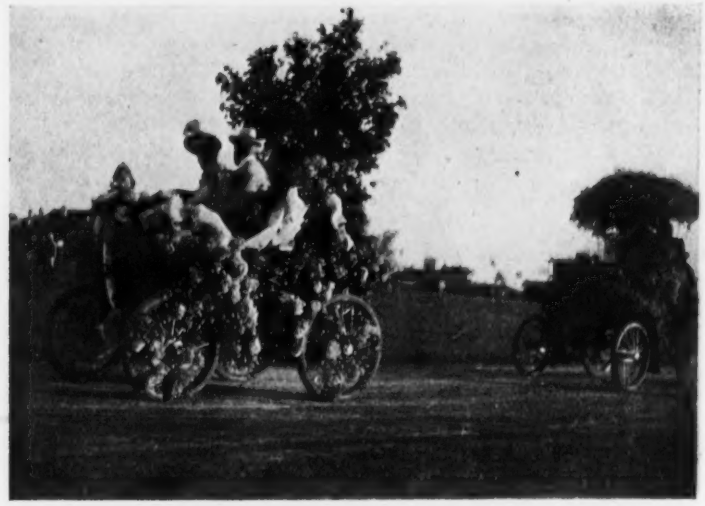
After all the carriages except the gasoline had gone over their course, they were formed in line and went through the principal streets of the city. Some are illustrated on pages 414 and 415.

The parade ended at Gray Craig, the model farm of Mr. O. H. P. Belmont, where the owner had erected a series of decorated arches leading through the trees to a specially built pavilion, where a dinner of fifty covers was found waiting. The table was 20 by 40 feet long and laid out as a miniature park with electric lights twinkling from the tiny trees, and around the border of an irregularly shaped artificial lake in which were young ducklings, which evidently enjoyed the distinction of being the centre of attention. During the dinner music was furnished by a Hungarian band brought from the city. After supper, the artificial park, lake and storage batteries, loaned by the New England Electric Vehicle Company, were removed in twenty-two minutes, when dancing begun on the floor now illuminated by electric lamps placed in the roof.

At ten the automobiles were turned homeward, each one lighting its hundred miniature lamps of various colors and original designs as it started. The effect of the illuminations on the decorations was perhaps more beautiful than the daylight. By twelve midnight all the automobiles were in the station of the New England Electric Vehicle Company, and the first decorated automobile parade in the Western Hemisphere was over. The first prize for decorations was a large silver bonbon box; the second prize was a silver floral vase; and the prize for best competition driving was a silver cup.

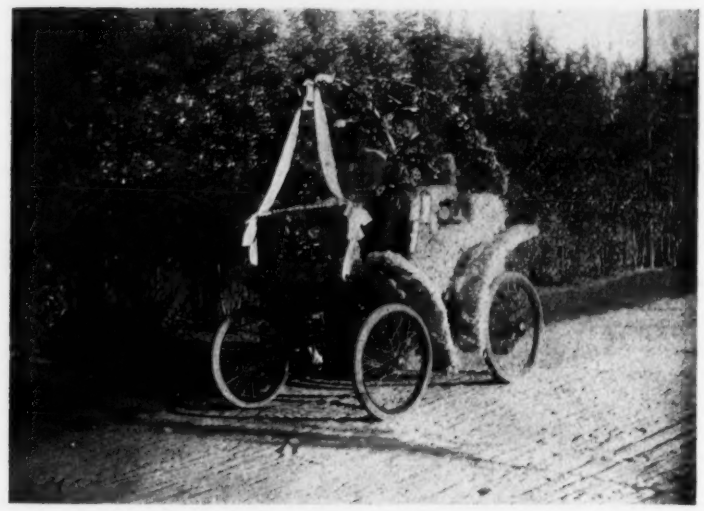


COLUMBIA ELECTRIC LADIES' VICTORIA.
MRS. HERMAN OELRICHS AND MR. W. MAX MULLER.
FIRST PRIZE.



COLUMBIA ELECTRIC STANHOPE AND GOLF BRAKE.
MRS. J. J. ASTOR AND MR. H. LEHR.
MR. AND MRS. WIDENER.

COLUMBIA ELECTRIC GOLF BRAKE.
MRS. O. H. P. BELMONT AND MR. J. W. GIRARD.



COLUMBIA ELECTRIC GOLF BRAKE.
MISS MARIE WINTHROP AND MR. H. TAYLOR.

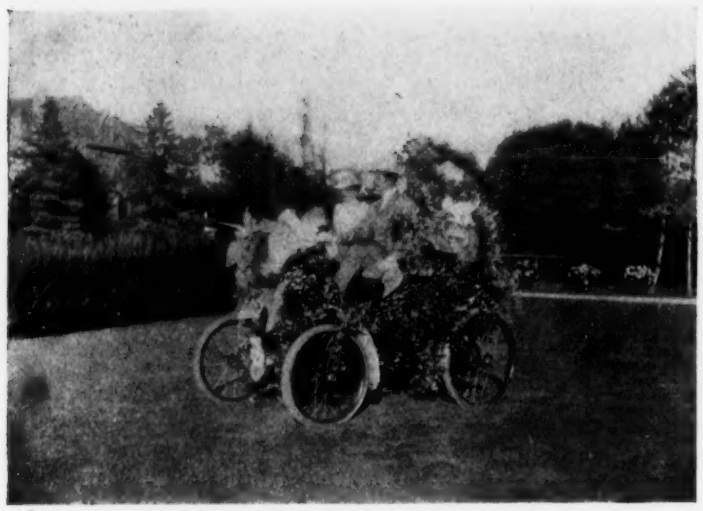
COLUMBIA ELECTRIC RUNABOUT.
MRS. STUYVESANT FISH AND MR. O. H. P. BELMONT.

GASOLINE WINTON.
MRS. CLARENCE MACKAY AND MR. ROGER WINTHROP.

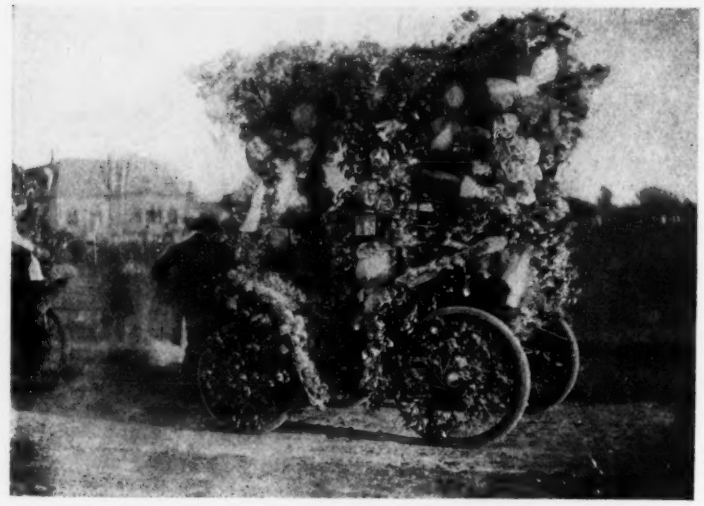
SOME SNAP SHOTS OF AUTOMOBILES IN THE FIRST DECORATED AUTOMOBILE PARADE, NEWPORT, RHODE ISLAND, SEPTEMBER 7, 1899.

STANLEY STEAM LOCOMOBILE.
MR. AND MRS. W. K. VANDERBILT.
FIRST PRIZE FOR SPEED.

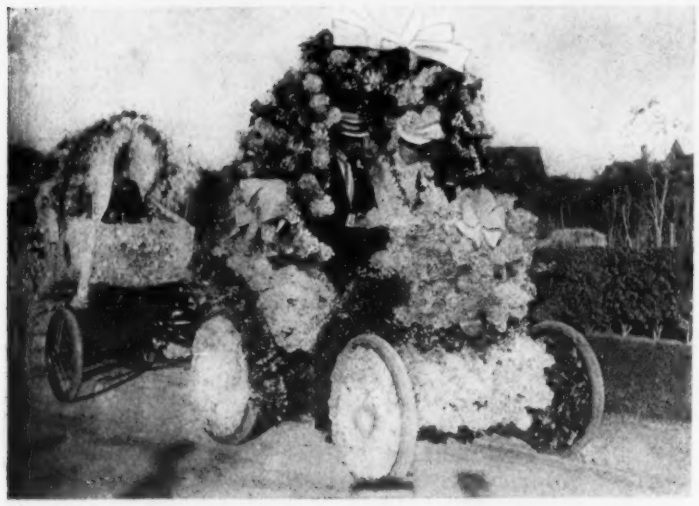
COLUMBIA ELECTRIC STANHOPE.
MRS. BURKE-ROCHE AND MR. M. M. SHOEMAKER.
SECOND PRIZE.



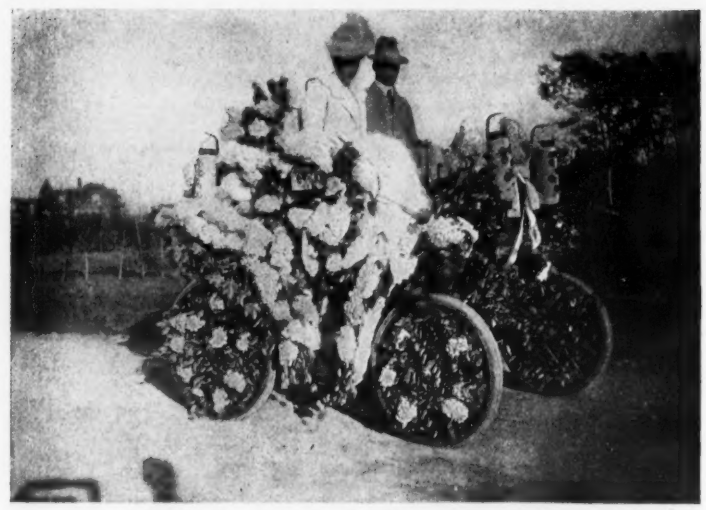
COLUMBIA ELECTRIC STANHOPE.
MRS. W. R. TRAVERS AND MR. C. A. DOLAN.



COLUMBIA ELECTRIC GOLF BRAKE.
MRS. E. ROLLINS MORSE AND MR. W. HUDE NEILSON.



COLUMBIA ELECTRIC STANHOPE.
MRS. J. R. DREXEL AND MR. REGINALD RONALDS.



COLUMBIA ELECTRIC GOLF BRAKE.
MISS SCOTT AND MR. PHOENIX INGRAHAM.

SOME SNAP SHOTS OF AUTOMOBILES IN THE FIRST DECORATED AUTOMOBILE PARADE, NEWPORT, RHODE ISLAND, SEPTEMBER 7, 1899.

The Electrical and Mechanical Resistance of Dynamo Brushes.

DATA relating to the electrical and mechanical resistance of dynamo brushes have been rather meagre, notwithstanding their practical value. During the past year an experimental investigation of the subject was undertaken in the electrical laboratory of Columbia University, which formed the matter of a thesis by Messrs. R. B. Tibbals, L. Lowenberg and W. G. Burns, who carried out the work.

The apparatus with which the tests were made, shown in Fig. 1, was constructed as follows:

A cylinder of cast iron, fastened to a wooden frame, supported a rectangular, hollow piece of brass, in which easily slid a piece of brass having at one end on the under side a U-shaped slot. This sliding piece of brass could be fastened in the desired position by a screw. A frame consisting of two long tubes of steel, fitted

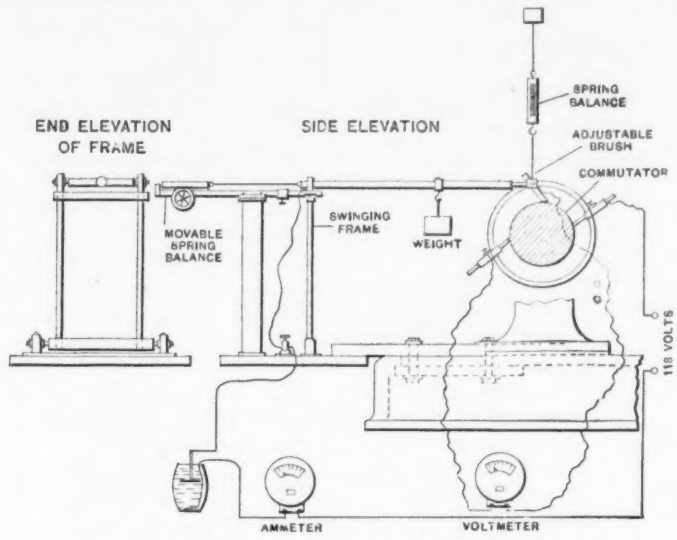


FIG. 1.—DIAGRAM OF APPARATUS AND CONNECTIONS.

into two pieces of brass at top and bottom. In the ends of the latter were holes for receiving two sharp-pointed screws, supported on the wooden frame. This gave it freedom of movement with minimum friction. Above the top cross piece were two similar screws to receive the cross piece of the rod carrying at its other end the brush to be tested. Hence any movement of the frame was produced by the influence of the rotating commutator on the brush. The upper cross piece of the frame fitted into the U-shaped slot. On top of the hollow piece of brass was fastened a spring balance attached to the end of the rod, carrying the brush, by a wire. Thus by bringing the frame in a central position, by turning a small wheel attached to the spring balance, the tangential pull of the brush could be read. The brush itself could be turned at any angle to fit the commutator. The rod carrying the brush was hung up and attached to a spring balance, so that it simply rested on the commutator without any initial pressure. The weights were hung on to the rod, and were calibrated to give the actual weight at the point of suspension.

For leading the current to the brush to be tested, a very flexible wire of many strands was attached to the brush rod, and the other wire was attached to a brush of the machine itself. The drop of the brush was measured by using a brush of the machine, the re-

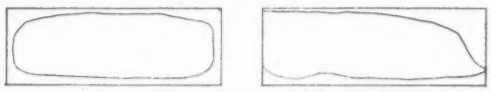


FIG. 2.—APPEARANCE OF BRUSHES AFTER ONE DAY'S RUN.

sistance of the latter not affecting the testing brush as it was in series with the high resistance of the voltmeter. The commutator was short-circuited by 30 turns of copper wire, so as not to measure the drop in armature coils due to residual magnetism. The dynamo upon which the first series of tests were made was an Edison upright 35-kw machine, belt driven. The commutator had 48 bars.

For a constant pressure the current was varied, which gave some interesting results, namely, that the resistance varies inversely with the current. This was true in every case and of every brush tested, which were, carbon, graphite, copper leaf and copper gauze. As these tests extended over several weeks, an attempt was made to have the conditions always the same. To this end, not only were the same instruments and wires used, but the commutator was cleaned and sandpapered each day. In addition to this the brushes were also very carefully fitted to the commutator. The copper brushes required very little attention after the first adjustment, but not so with carbon and graphite. They had to be fitted daily, and after each day's test presented the appearance shown in the diagram, Fig. 2.

Observations upon other machines showed exactly the same result. An explanation of this may be found in the fact that the eddy currents flowing about the edges of the brush probably eat away the carbon and graphite there, but do not penetrate to the centre, which consequently wears down to the shape of the commutator. When the commutator was newly sandpapered the resistance of the copper leaf brush fell to zero, but remains so for a few seconds only, as has been pointed out by Messrs. Edsall and Roity, of Cornell. This was so only of the copper leaf brush. Nothing less than two pounds pressure could be used advantageously on the carbon brush, as otherwise the voltmeter varied so much as to make it impossible to obtain accurate readings. This is also true of the graphite brush, but not to so marked a degree. This effect is considerably lessened at half speed. The results have been tabulated and drawn out in curves, which are given below. The copper brush was also tried on a cast-iron pulley. A brush was cast from Babbitt metal and tried on the cast-iron pulley, using exactly the same apparatus as described above. When the pulley was dry, the results were not good at all. The brush sparked violently with even 10 amperes, and at higher values of the current it commenced to fuse. However, when the pulley was oiled with heavy machine oil, the results were very different. The brush had been fused so that it fitted the pulley perfectly, and the running became very smooth, there was absolutely no sparking and consequently no fusing. The pulley must be oiled constantly, for as soon as the oil dries it leaves a gritty substance on the pulley, which increases the friction very considerably. From the tests made the following conclusions can be drawn:

1. The resistance of all brushes varies inversely as the current.
2. The resistance remains nearly constant for increase of pressure except at low currents.

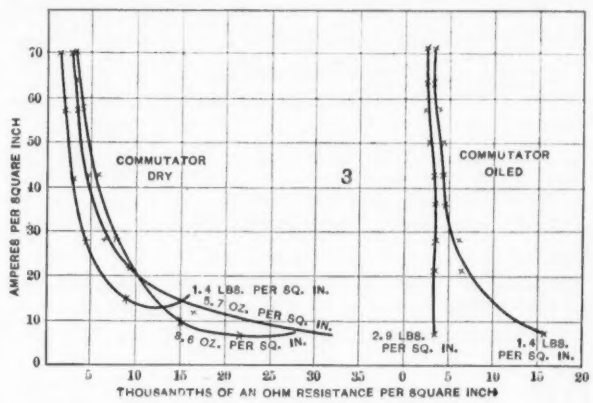

AMPERES PER SQUARE INCH
COMMUTATOR DRY
3
COMMUTATOR OILED
1.4 LBS. PER SQ. IN.
5.7 OZ. PER SQ. IN.
8.6 OZ. PER SQ. IN.
2.9 LBS. PER SQ. IN.
1.4 LBS. PER SQ. IN.
THOUSANDTHS OF AN OHM RESISTANCE PER SQUARE INCH

FIG. 3.—CURVES SHOWING TESTS WITH COPPER LEAF BRUSH.

3. The drop of all the brushes remains almost constant with increase of current, increasing slightly.
4. The tangential pull of all the brushes increases with the pressure.
5. The tangential pull of copper leaf and copper gauze generally increase with the current but not invariably.
6. The tangential pull of carbon and graphite decreases with increase of current. In the case of carbon, this is especially true at ½ and ¾ speed. With graphite the pull increases with increasing current at ¾ speed.
7. The tangential pull is decreased considerably when the commutator is oiled. In the case of carbon and graphite at low pressures, the friction is slightly increased.
8. For copper brushes at ½ speed the tangential pull or friction is considerably increased; at ¾ speed only very slightly in-

creased. For both these speeds the resistance is the same except for low currents.

9. On a cast-iron pulley, the resistance of copper brush is considerably reduced, while the friction is about the same.

10. For copper gauze and carbon the results at ½ and ¾ speed are practically the same as at full speed.

11. For graphite brushes, the pull is greater and the resistance less at ½ speed, but at ¾ speed the pull again becomes nearly the same as at full speed, the resistance still being less.

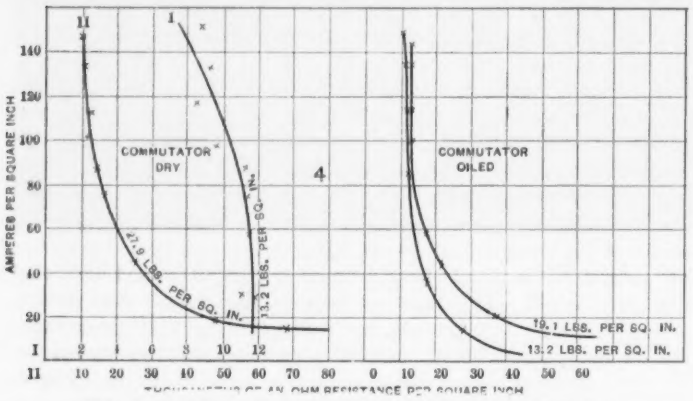


FIG. 4.—CURVES SHOWING TESTS WITH CARBON BRUSH.

The conclusions from experiments with the Babbitt metal brush are as follows:

1. The resistance and pull vary just as that of the other brushes do.

2. With a dry commutator there is excessive sparking, fusing of the brush and exceedingly noisy running.

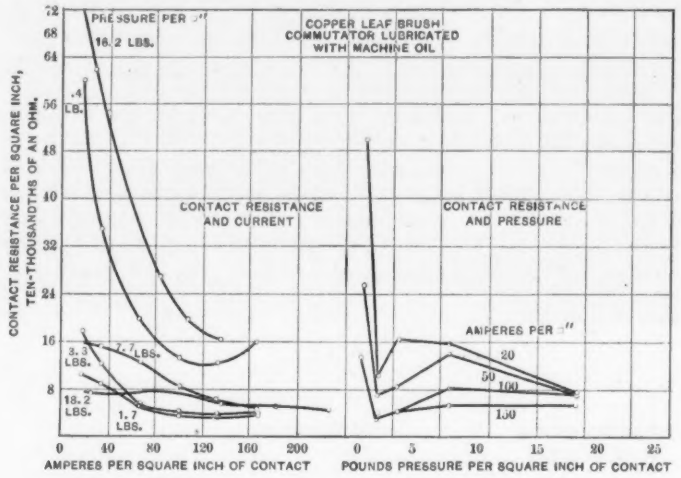


FIG. 9.—COPPER LEAF BRUSH COMMUTATOR LUBRICATED.

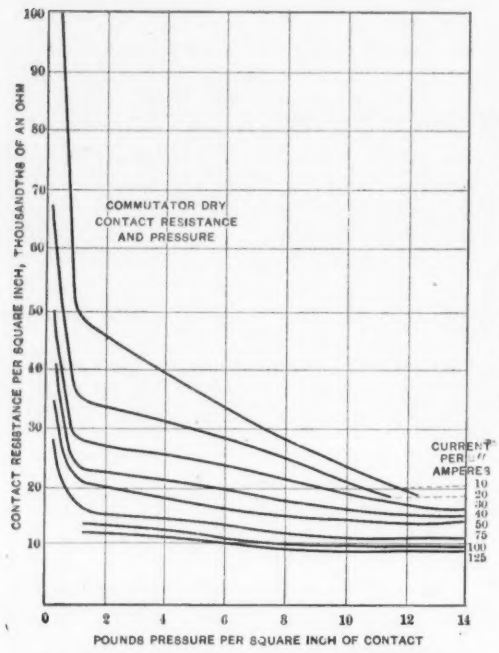

CONTACT RESISTANCE PER SQUARE INCH, THOUSANDTHS OF AN OHM
COMMUTATOR DRY
CONTACT RESISTANCE AND PRESSURE
CURRENT PER □" AMPERES
POUNDS PRESSURE PER SQUARE INCH OF CONTACT

FIG. 5.—CARBON BRUSH, COMMUTATOR DRY.

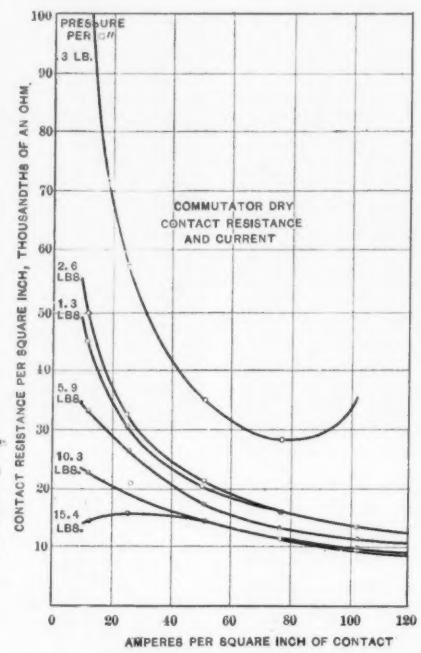


FIG. 6.—CARBON BRUSH, COMMUTATOR DRY.

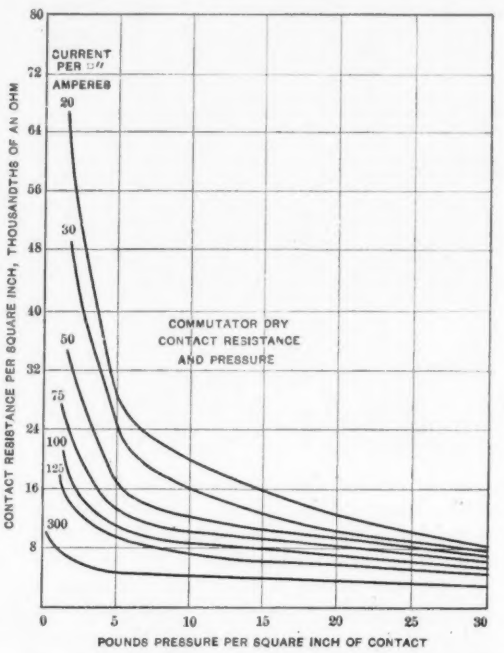

CONTACT RESISTANCE PER SQUARE INCH, THOUSANDTHS OF AN OHM
CURRENT PER □"
AMPERES
COMMUTATOR DRY
CONTACT RESISTANCE AND PRESSURE
POUNDS PRESSURE PER SQUARE INCH OF CONTACT

FIG. 7.—COPPER LEAF BRUSH, COMMUTATOR DRY.

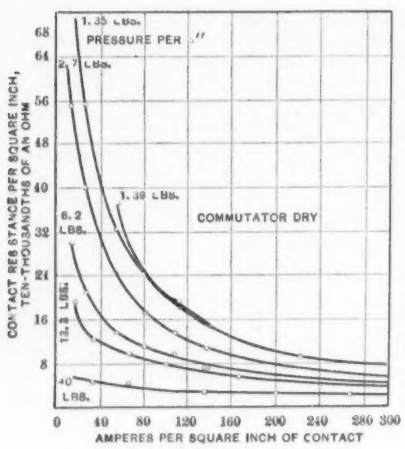
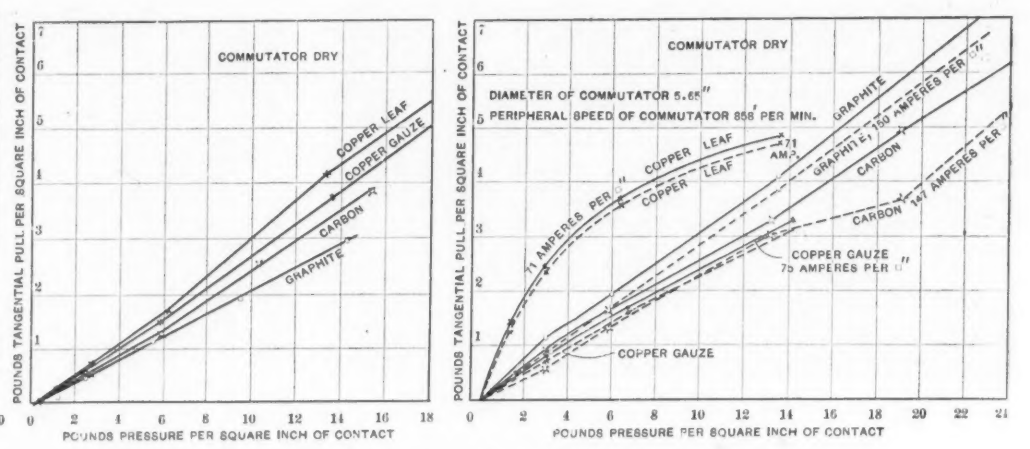


FIG. 8.—COPPER LEAF BRUSH.



FIGS. 10 AND 11.—BRUSH FRICTION, COMMUTATOR DRY.

12. The copper brushes run much more smoothly, give a much steadier drop, and do not spark as much when properly adjusted as the carbon and graphite brushes do.

3. When oiled with machine oil, the brush runs better than any of the others tried. The drop is steadier, there is absolutely no sparking, and the friction is less than ½ as much as for copper.

4. These results hold true also for kerosene oil, and probably would be more marked but for the fact that the oil evaporates very quickly; the smallest spark will dry off the pulley completely, producing the result stated above.

5. The friction increases with increasing current. Oiling the commutator reduced the resistance of copper gauze brushes in most cases. The curves in Figs. 3 and 4 show the result of the tests on carbon and copper leaf brushes, with the commutator dry and oiled.

To determine the contact resistance of brushes on a large commutator, tests were made on one of the 200-kw dynamos of Columbia University, having the following data:

Number of sets of brushes, 8; number of brushes per set, 8; diameter of commutator, 2 feet 8 inches; length of commutator, 1 foot 9 inches; width of commutator bars, 11-32 inch; width, centre to centre of mica, 3/8 inch; number of bars, 268; speed, 101 revolutions per minute; peripheral speed of commutator, 846 feet per minute.

The same apparatus was used as employed in the previous tests. The connections were also the same. Current was led into the machine by one set of brushes, passed through the coils of the armature, to the top commutator bar, thence out through the testing brush. To prevent any drop of voltage due to current in the coils, as the bars were not short-circuited, the voltmeter brush had to be placed on the same commutator bar as the testing brush. For the former brush, a copper strip was used, adjustable to move forward or backward.

When the machine was in motion, residual magnetism caused a small current to flow through the armature. The short-circuiting of the coils by the brush tended to cause sparking, and also a small drop of voltage, which difficulty was at first very apparent in the case of the copper leaf brush, but was reduced to a minimum by employing a narrow brush, and placing it as nearly as possible in the neutral plane. The drop of voltage was further prevented by shifting the voltmeter brush forward or backward till the voltmeter read zero, before passing current through the machine. This had to be continually adjusted, as the slightest change of position of the testing brush caused a deflection of the voltmeter.

It was possible to use much smaller pressures with the carbon and graphite than in the former tests without causing sparking. With commutator dry this was the case with as low a pressure as .3 pound per square inch for graphite, and 1.3 pound for carbon, but with commutator oiled, the former pressure for graphite caused sparking with large currents. Both carbon and graphite brushes fitted perfectly to the commutator.

Cylinder oil is not to be recommended, as it is too thick, resulting in lines of scum on the commutator, which increases the resistance, and can only be removed by a vigorous application of sandpaper. On the other hand, machine oil is a positive advantage, as it leaves no scum, and reduces the resistance of copper brushes.

The following conclusions were reached from the above tests:

COMMUTATOR DRY.

1. The tangential pull increases directly with the pressure.

2. The tangential pulls of the brushes are as follows, decreasing in value in the order named: Copper leaf, copper gauze, carbon, graphite.

COMMUTATOR OILED.

1. The tangential pull increases with the pressure, but not in direct proportion.

2. Between the limits of 2 and 7 pounds per square inch pressure and no current, the tangential pull of copper gauze is slightly greater than that of copper leaf; between 3½ and 15 pounds and no current, the pull of graphite exceeds that of carbon; between 2½ and 8½ pounds the pull of copper gauze and leaf exceeds that of carbon or graphite.

3. The tangential pull of carbon and copper gauze decreases with increase of current.

4. Oil increases the tangential pull with no current.

COMMUTATOR DRY.

1. The resistance varies inversely as the current. The variation is very large with small currents, but small with large currents, approaching a constant resistance as a limit.

2. The resistance varies directly with the pressure. The variation is very large with small pressures, up to a certain critical point, beyond which it is very small.

3. The effect of pressure on the variation of resistance is greatest with small currents. With increase of current the critical point becomes more defined and corresponds to a smaller pressure, while increase of pressure beyond this point has less and less effect, till finally with increase of pressure or current, the resistance is but slightly affected.

4. With copper gauze brush, there is no well defined critical point.

5. The resistance of carbon is slightly less than that of graphite.

6. The resistance of copper leaf with very small currents is about the same as that of copper gauze, but with very large currents it exceeds that of the latter.

7. The resistance of carbon and graphite brushes greatly exceeds that of copper.

COMMUTATOR OILED.

1. Cylinder oil increases the resistance of graphite brushes especially at small currents; with carbon at very small currents the resistance is increased, but with large currents it is nearly the same.

2. Machine oil reduces the resistance of copper leaf brushes at small pressures, and greatly reduces that of copper gauze.

Following is a comparison of the effect of large and small commutators at peripheral speed of 850 feet per minute:

COMMUTATOR DRY.

1. The tangential pull of graphite and copper leaf with large, is much less than with small, commutator; with no current, that of copper gauze is slightly less up to 6 pounds per square inch pressure, beyond which it is greater; that of carbon is less up to 13 pounds, beyond which it is the same.

2. With small commutators, the tangential pulls are as follows, decreasing in value in the order named: Copper leaf, graphite, carbon, copper gauze (no current).

3. With large commutator, with carbon and graphite, the pull remains practically constant with increase of current, whereas with small commutator it decreases.

COMMUTATOR OILED.

1. With large commutators, oil generally increases the pull, while with small commutators (speed 1580 feet) in the case of copper it decrease, except at very small pressures.

2. With small commutators (speed 1580 feet) machine oil greatly reduces the resistance of copper gauze and leaf—in case of the latter, especially with small currents; the reduction with large currents being greater with copper gauze. Machine oil reduces the resistance of carbon and graphite except with small currents. With graphite the reduction becomes less marked with increase of pressure.

3. With small commutators (speed 1580 feet), the tangential pull of graphite and copper gauze slightly decreases with increase of current. This holds for carbon in some cases but not always.

COMMUTATOR DRY.

1. Graphite.—With small commutators and small currents, the contact resistance is greater than with large commutators, but with large currents becomes nearly the same.

2. Carbon.—With large commutators and small currents, the resistance is greater than with small commutators, but with large currents it is only slightly greater.

3. Copper Leaf.—With 1.4 pound per square inch pressure, the resistance for all currents is nearly the same with either commutator; but with greater pressures, it continually decreases with large commutators, whereas it remains nearly constant with small commutators.

4. Copper Gauze.—For 1.5 pound pressure and 75 amperes per square inch, the resistance with small commutators is but slightly greater than that with large commutators; but with small currents the resistance with small commutator becomes much greater. With increase of pressure, the same result as with copper leaf.

The results of some of these tests are shown in the curves, Figs. 5 to 11, inclusive.

Popularity of Automobiles.

A despatch from London says: The craze for automobile riding is on the increase in this country. Manufacturers either here or in France cannot turn them out fast enough, and leading English firms are overwhelmed with orders. "Motoring" will be as great a craze next season in England as it is in France now. Most of the cycle makers of Coventry and Birmingham are experimenting in motors. Petroleum is the motive power used in every case, electricity being rejected owing to the necessity for charging stations.

CURRENT NEWS AND NOTES.

AGAINST THE AUTOMOBILE.—Petitions asking for ordinances prohibiting the use of automobiles on the public streets are being circulated in some of the Atlantic coast towns. This demonstration, like that once made against the bicycle, comes from the horse's best friend—the livery stable keeper.

A CORRECTION.—Through a typographical error, the name of the writer of two letters which appeared under the head of "Wireless Telegraphy" in our issues of Aug. 12 and 26, respectively, was incorrectly printed. The signature should have been S. Z. Quint, instead of S. Z. Flint, as printed.

THIRD RAIL SUBURBAN SERVICE.—The New York, New Haven & Hartford Railroad has made preparations, it is said, to put in a third-rail electric line for passengers between New York or Harlem River and New Rochelle. The company has for several years successfully operated a short third-rail line south from Nantasket towards Plymouth in Massachusetts.

FRENCH CABLE TO CAPE COD.—The steamship Francois Arago, from Calais, will begin laying an extension of the French cable from Coney Island to Cape Cod this week. The ship belongs to the French Cable Construction Company. She was formerly the Westmeath, and was owned by the Telegraph Construction & Maintenance Company, of London. She laid the cable from Halifax to Bermuda.

THE CUBAN CABLE.—With the aid of the United States Government lighthouse tenders the Western Union Telegraph Company has completed the laying of the new cable between Miami, Fla., and Key West more quickly than had been expected. The work of laying the line to Havana has been begun. The shore end will be landed at San Lazaro, on the north beach of Havana, to which point the old cable ends will be transferred from Cojemar.

TELEGRAMS BY POSTAL CARD.—The Vienna Chamber of Commerce has petitioned for the introduction of telegram post cards and telegram letter cards, the invention, like the ordinary post card, of Prof. Dr. Hermann. They would be posted in the usual way, and the messages written on them would at once be telegraphed or telephoned from the post office to the receiving office, and there transferred to other cards, which would be delivered with the ordinary letters.

DOTAGE AT CAMBRIDGE.—In a paper on "The Fundamental Principles of Algebra," read by Prof. Alexander Macfarlane at the Columbus meeting of the American Association for the Advancement of Science, the tardy recognition at Cambridge (England) of the differential notation of Liebnitz as opposed to the fluxional notation of Newton is referred to as follows: "About the year 1812 a school of mathematicians arose at Cambridge which aimed at introducing the d-ism of the Continent in place of the dot-age of the university."

LEAGUE OF AMERICAN MUNICIPALITIES.—The annual convention will be held at Syracuse, N. Y., Sept. 19 to 20. Discussions will take place on the following subjects: Civil service; municipal ownership; municipal charities; the special assessment system; the contract system in making public improvements; water supply; drainage; sewerage, and the disposal of garbage. A feature of the convention will be the question box, into which delegates will be asked to deposit written inquiries pertaining to any municipal matter upon which they desire special information. An extra session will be devoted to answering the questions. A special debate is promised on the municipal ownership question, touching electric light plants, etc.

AMERICAN ELECTRIC AUTOMOBILES AT THE PARIS EXPOSITION.—At the late Exposition des Automobiles in Paris electric automobiles were represented by 63 vehicles shown by 19 different exhibitors. Of these 33 were pleasure vehicles, 17 of the type of vehicle for hire, 2 were omnibuses and 8 are delivery wagons. But one American firm was listed as such, the Cleveland Screw Company, which exhibited five Sperry vehicles. Columbia automobiles, however, were represented by nine vehicles exhibited by the Société l'Electromotion, and a Riker phaeton was shown in the exhibit of the Société l'Automobiles. The automobiles shown by the Société des Electromobiles were equipped with motors of the Johnson-Lundell type. Various features of the exhibition have already been noted in these columns.

OBJECTING TO CABLE FORECASTS.—Inasmuch as the U. S. Weather Bureau officials are on the lookout constantly and report promptly the approach of any unusual or sudden change in the meteorological conditions, Chief Moore is of the opinion that the cable companies' operations should be restrained from disseminating reports which may cause unnecessary alarm. With this object in view, he sent out this week the following despatch to the officials of the Halifax & Bermuda Cable Company, the United States & Haitien Cable Company, and the International Oceanic Cable Company: "For the good of humanity and in the interest of commerce will you please not cable any West Indian hurricane forecasts unless emanating from the United States Weather Bureau? A baseless forecast may be the cause of much unnecessary consternation."

REWARDING FAITHFUL EMPLOYEES.—The Cincinnati Street Railway Company has adopted a substantial manner of rewarding the faithful services and diligence of its employees. By the unanimous action of the board officers it was determined to present $5000 annually to the Employees' Mutual Protective Association. This will enable the association to pay all sick and death benefits without the payment of dues by members or the levying of assessments. The association has been in existence for several years. Many of the men with large families find it difficult to pay even the small dues, and the action of the directors will be particularly appreciated by them. The directors also recommend a change in the constitution of the association so that any member shall receive 75 per cent. of his daily salary for each day that he is sick or disabled.

CHINAMEN AND AUTOMOBILES.—In a report on the difficulties of selling automobiles to Chinamen, Consul General Goodnow, at Shanghai, gives his views of the Chinese character. He says that it is simply impossible to sell anything which they have not seen to wealthy Chinese. They shy at automobiles because they have never seen any, and cannot imagine what they are like. This habit of mind has infected even the foreigners at Shanghai, and urges American dealers not to try to sell automobiles to either Chinese or foreigners by means of descriptions or catalogues. He proposes that dealers make a present of an automobile to some well known person in Shanghai, making him agree to use it constantly and prominently, so that the Chinese may become accustomed to the startling innovation. The place, he says, is the ideal for motor vehicles. The town is level, the roads macadamized, and the climate such that everybody drives. The report is sent in answer to some queries from a Chicago firm.

MILWAUKEE CAR FARES.—In return for desired franchise extensions, the Milwaukee Electric Railway Company has made an offer to the city of a gradual and increasing reduction of the rates of fare, and of an option on the property to be exercised by the city at any time. The proposition for reduced fares provides for the division of the unexpired term of the present franchises into four equal periods. For the first period, 1899-1905, a reduction by selling commutation tickets twenty-two for $1; for the third period, 1905-11, twenty-three; for the third period, 1911-18, twenty-four, and for the fourth period, 1918-24, twenty-five for $1. This would mean an immediate reduction of 10 per cent., and figures were presented to show that the proposal meant a loss to the company and a gain for its patrons for the unexpired time of the franchise of $5,296,229. The figures were based on the result of the sale of commutation tickets in Cleveland, where 63.52 per cent. of the receipts were from cash fares and 36.47 from the sale of tickets at twenty-two for $1. It is assumed that these proportions would change as the number of tickets to be had for a dollar would be increased, and as the people learned to appreciate the opportunity for economy, so that by 1918 at least three-quarters of the receipts would be from the sale of tickets. The estimated annual increase in passengers carried is 3 per cent.

MARRIED WHILE ON TROLLEY.—A unique wedding occurred in one of the suburbs of Columbus, says the *Atlanta Constitution*, when Eugene Smith and Miss Lillie Satcher, young people of East Highlands, were married on a street car. The preacher who was to wed them, the Rev. J. W. Simmons, was on the car hurrying to meet an appointment, and did not have time to leave the car. Accordingly the car stopped for a minute or so at Wildwood Park. The young people stood up in the car and the minister married them in the presence of the passengers. The marriage was followed by congratulations all the way round as the motorman turned on the full current to make up for lost time and the car whizzed through space. It was not a runaway match, the couple merely failing to meet the pastor at his house on time as by appointment.

ELECTRIC SMOKE ALARM.—A patent issued September 5 to Henry C. Baer describes an invention having for its object the giving of an audible alarm through the agency of smoke or non-flame supporting gases such as are ordinarily generated by fire. The device is based upon the principle that a flame of gas or other combustible material is only supported when supplied with a definite amount of oxygen. This principle is utilized by causing the flame to act upon a thermostatic bar included in the electrical circuit with an electric alarm of any well-known form; the circuit being normally open so long as the flame continues and the arrangement being such that when the flame is extinguished the circuit will be closed, thereby causing an alarm to be sounded at any desired point. The apparatus consists of a perforated casing containing a gas flame, supplying heat to a thermostatic bar. Should an abnormal condition take place in the surrounding atmosphere such as is attributable to the presence of smoke, the smoke will be drawn into the casing, the flame will be extinguished from lack of oxygen to support combustion and the thermostatic bar, becoming cooled, will close the circuit and sound an alarm.

THE GAS VS. THE STEAM ENGINE.—The following discussion of the relative economy of the gas and steam engine is from a recent publication of a large manufacturer of both types. A correct answer to the question "What is the comparative cost of operating a gas engine and a steam engine of equal power?" is stated to involve a special solution for each individual case. "Considered solely as a machine foo converting the total energy of the fuel into mechanical work, the gas engine is by far the more efficient. There are gas engines in operation which transform over 25 per cent. of the heat in the fuel into useful work, while in the very best recorded performance of the steam engine barely 14 per cent. of the energy in the coal burned has been thus accounted for, and in the average steam engine plant, not to exceed 5 per cent. There are many small plants, consisting of common slide valve engines, with uneconomical types of boilers, in which less than 2 per cent. of the energy in the coal burned is converted into mechanical work. At the same time it must be remembered that a given number of heat units in the form of fuel suitable for use in a gas engine costs more than an equal number in the shape of coal or other ordinary fuel suitable for burning in a common boiler furnace. As a general proposition it may be assumed that in a plant which operates continuously the item of fuel alone will be somewhat greater for the gas engine than for an approved type of modern steam engine, except possibly in the case of an engine running on producer gas. Where the service is of an intermittent nature, or the power is required only for a comparatively short time each day, this difference in favor of the steam engine becomes less, and may even become a balance in favor of the gas engine, for the reason that in the gas engine plant there are no 'stand-by losses,' i. e., radiation and leakage when standing idle under full steam pressure, and coal burned in banking fires and raising steam. With the gas engine the fuel expense starts and stops with the engine. But the fuel cost is only one item in the cost of producing power. One must consider the value of the additional space and buildings required for a boiler plant; the cost of a stack; labor of handling coal and ashes; cost of attendance, oil and water; depreciation, repairs and insurance on a boiler plant. The gas engine has a field of its own which cannot be occupied by the steam engine, and there is no immediate prospect of the gas engine seriously encroaching on the legitimate field of the steam engine." Some important considerations are here set forth very clearly and concisely.

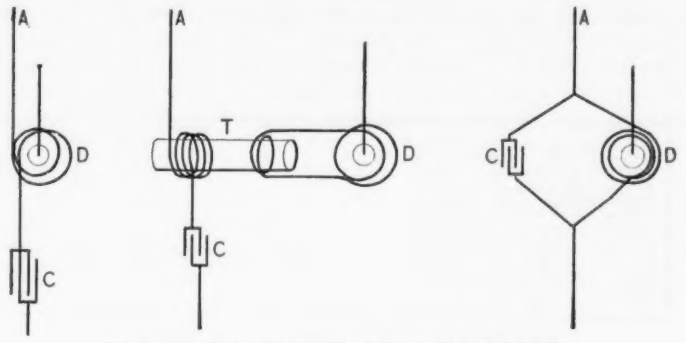
LETTERS TO THE EDITORS.

Wireless Telegraphy.

To the Editors of Electrical World and Engineer:

Sirs:—In addition to the methods previously pointed out by me as suitable for receiving wireless telegraphic signals, I would call attention to the following additional methods, all of which give good results. In each case the dynamometer-galvanometer, with short-circuited movable coil, described in my previous note (page 239, Aug. 12), is used. Instead, however, of using a single ring of aluminum or magnesium, suspended by a quartz fibre, a ring of many turns of fine wire may in some of the cases be used with advantage, depending upon the winding of the primary.

Although, as mentioned before, a permanent field is often an advantage, as the first part of the wave is the strongest, yet in some of the cases this is not so, and the permanent field may be dispensed with. In the accompanying sketches, *A* is the collecting



FIGS. 1, 2 AND 3.—DIAGRAM OF ARRANGEMENTS.

wire; *C*, a condenser; *D*, a dynamometer-galvanometer, and *T* a Thomson transformer.

Case 1. The condenser (Fig. 1) is insulated from ground and the wave simply oscillates back and forth, moving the galvanometer coil till what energy is not used in moving the coil is wasted in resistance losses.

Case 2. Here an air core transformer (Fig. 2) is used, as before, with or without a condenser in series with the primary, or, in this case, even in the secondary. The transformation is down, however, and not up, so as to get considerable current in the galvanometer.

Case 3. Here the galvanometer is in shunt with the condenser, and there may or may not be another condenser in series with both, which may or may not be connected to ground. I have got the best results without condenser and with ground, but have got good results in either of the two other ways. (See Fig. 3.)

As regards sensitiveness, I have found that it takes about 1-50 erg to work a coherer, i. e., about 50 volts and about 3×10^{10} amperes.

But any good galvanometer will work with 10^{10} amp. and 10^{7} volts, with a period of 10 sec. For a period of 1-10 sec. this would be 10^{11} watts, or 10^{4} ergs. Theory, therefore, indicates that my method can be made more sensitive than using the coherers, and in fact experiment shows this to be true, though I doubt if my coherers are as sensitive as Marconi's.

REGINALD A. FESSENDEN.

ALLEGHENY, PA.

Features of Motor Starting Rheostats.

To the Editors of Electrical World and Engineer:

Sirs:—I have read with much interest the article by Mr. Mattick on "Motor Starting Rheostats," and while I agree with Mr. Mattick on most of the points he makes as to the requirements of a first-class motor starter, it seems to me that he is too strong in his criticism of the use of copper and iron for rheostats. These materials can, in certain cases, be satisfactorily used, although personally I have never employed either except experimentally, as they certainly are not so good as the alloys of the German silver type, and the saving by their use does not compensate for the objection that well informed engineers are likely to raise against their use.

The best point made by Mr. Mattick is, in my opinion, that every motor starter should have an electromagnetic circuit breaker as an essential feature of its design, and that the circuit breaker should be entirely independent of the operating arm of the rheostat. I do not know of any insurance so cheap as the insurance of the value of the motor and rheostat which the trivial first cost of such a circuit breaker attachment affords, and in this connection I beg to say that I was the first one to place such a rheostat on the market, and that I have urged its use for many years past. The New York Fire Department, about two years ago, made such a device obligatory in the case of motors of one horse-power. To-day its use is not obligatory, but nevertheless the use of such rheostats made by various manufacturers is rapidly becoming universal in the principal electrical centres, and I feel confident that the Fire Underwriters will eventually insist on such a protective device in connection with all motors except very small ones.

A modern enclosed fuse is a good protective device, but unfortunately it will only act once, and in the case of most motors the overload protective device is called upon to act frequently. The practical result of this, as we all know, is that the engineer decides that the fuse which would really protect the circuit properly is "too small," and he proceeds to put in a much heavier fuse and his protection is almost entirely done away with. If an extremely heavy and dangerous overload should blow the heavier fuse once or twice, the old familiar link of copper wire would soon be in evidence and the next time a severe overload occurred a new armature, and possibly the fire department, would be in order.

I agree with Mr. Mattick that a circuit breaker arm which the operator holds in his hand while starting the motor is ineffectual, as such action prevents the circuit breaker from acting in the presence of a dangerous current. The circuit breaker portion should be absolutely independent of the operator while he is starting the motor, otherwise you are relying upon the operator for your protection instead of the circuit breaker which should be uncontrollable except automatically by excessive current in the circuit.

It seems almost unnecessary to emphasize Mr. Mattick's criticism of the open coil type of rheostat. Like the exposed winding on the surface of armatures and the open fuse, it belongs to the early days, before we knew better. All advanced rheostat builders, both in this country and abroad, have long ago abandoned the types of rheostats in which the wire is kept in position merely by its own strength and could uncoil if melted or broken by strain. The enclosed type of motor starter has come to stay just as surely as the enclosed fuse and the enclosed armature winding.

H. Ward Leonard.

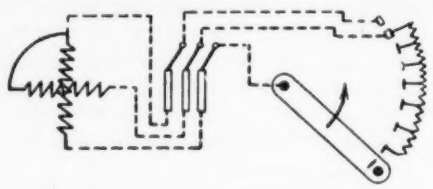
Bronxville, N. Y.

DIGEST
OF
Current Electrical Literature.

By CARL HERING.

Dynamos, Motors and Transformers.

Starting Resistance for Induction Motors.—Niethammer.—A short, well illustrated description of the various types of starting resistances for induction motors, which have been suggested. A very simple starting resistance for two-phase armatures is illustrated in



the adjoining figure; the two ends of the two circuits are closed by a single, ordinary step-by-step resistance; the last contact is connected with the junction point and the contact arm is broad enough to form a bridge over the two last contacts. Care must be taken not to cut out the resistance too quickly. This arrangement is a saving of resistance of about 30 per cent. A similar arrangement for three-phase armatures, but which involves a little dissymmetry, is also described and illustrated.—*Elek. Zeit.*, Aug. 24.

Alternator Design.—Scott.—A communication pointing out the advantages of the moving coil alternator over the Mordey induction alternator. Either greater speeds or a greater number of poles are required for the inductor type, as the magnetic lines of force are merely diminished from a maximum to zero and not reversed by the passage of each projection of the inductor wheel. Except for high speeds, the inductor alternators would seem to work out larger, heavier, and therefore more expensive for the same output than those with moving field magnets. Further, in order to get rid of the heat representing the loss of energy, if the field winding is prevented from revolving, it must necessarily be so disposed as to give a greatly increased cooling surface, and this usually means increasing the dimensions of the machine, and therefore the cost. The gain in doing away with the collector and brushes is said to be without great value.—Lond. *Elec.*, Aug. 25.

Alterations of Alternators.—Scott.—An illustrated article on the alterations made by Ferranti to the Brush Company's alternators at the City of London electric lighting station. One great fault in the original construction was too short an air gap, so that the coils could not be kept quite true, and therefore the current showed a tendency to flash across to the pole castings; the air gap was widened and the number of turns on the armature coils increased. The particulars of the alterations to the armature coils, the winding of the coils, the coupling up the armature, the fixing of the field coils, the pitching of the poles, etc., are described and illustrated.—Lond. *Elec.*, Aug. 18.

Sparking at the Brushes.—Three illustrated communications on the question, What is to be done, if the brushes of a continuous current dynamo spark badly and if the trouble is not overcome by altering the lead? Tests should be made to find if any of the coils are short-circuited, or if a connection is broken, or if the connection of a coil is wrong, or if the resistances of the coils are unequal.—Lond. *Elec. Eng.*, Aug. 18.

REFERENCES.

Testing Dynamos.—Fischer-Hinnen.—A short reply to a communication of Dettmar (Digest, July 29). He still claims the correctness of his previous statements (Digest, June 24), and gives some points in defence of them.—*Elek. Zeit.*, Aug. 17.

Dynamos for Electrotyping.—A reprint of the three communications mentioned in the Digest, July 29.—*Sc. Am. Sup.*, Sept. 2.

Lights and Lighting.

Arc Lamps With and Without Globes.—Laporte.—A note giving the results of measurements on an alternating current arc lamp, without and with an opal globe and a reflector. The voltage at the lamp, including the external resistance, was 40 without and 39.5 with the globe; the current 14 and 13.7 amp., respectively; the power factor 0.81 and 0.80; the power consumed in the lamp 455 and 434 watt; the average hemispherical intensity 403 and 305 candles; and the specific luminous flux 5.5 and 4.4 lumens per watt; thus showing an absorption of about a fifth of the light by even a very transparent globe.—*L'Ind. Elec.*, July 25.

Brightness of Sources of Light.—Jenko.—Taking as the unit of intrinsic brightness, that of a sheet of Bristol cardboard illuminated by a standard candle at one meter distance (that is, illuminated by what is usually called a meter candle), he deduces the intrinsic brightness of sources as follows: Of the candle flame it is from 12,000 to 20,000; the kerosene light flame, 97,000; Violle's unit (platinum at its melting point), 1,008,000. Of several white surfaces which were compared, magnesium carbonate was found to be the best for photometric purpòses as its brightness was the highest and it was most completely free from regular reflection.—*Wied. Ann.*, 66, p. 1182; noticed briefly in *Science Abstracts*, July.

Lighting of a Tunnel.—A very brief description of the way in which it is proposed to light the Batignolles tunnel near Paris. A line of incandescent lamps of 10-cp will be placed a meter apart along the side of the tunnel, and at the height of the windows of the carriages; they will be automatically lighted and extinguished by the passage of the train. In this way, it is claimed, any train stopping

in the tunnel will be lighted fairly well from the outside, and with much less electrical energy than if the tunnel were lighted continually.—From the *Revue de l'Elec.*; abstracted in Lond. *Elec. Eng.*, Aug. 25.

Incandescent Lamps for Lighthouses.—A note referring to the proposal of the use of the Nernst light in lighthouses (Digest, Aug. 19) and stating that the kind of light that most readily penetrates a foggy atmosphere is that having orange and red rays, such as the light of an ordinary incandescent lamp, which therefore is claimed to be particularly well adapted for lighthouses.—*Eng. News*, Aug. 24.

Electric Light for Lighthouses.—IRWELL.—In an article on the different methods of illuminating lighthouses, he points out the disadvantages of the electric light for this purpose, but agrees that for sky flash signals the electric light has proved to be thoroughly satisfactory.—*Sc. Am. Sup.*, Sept. 9.

REFERENCES.

Incandescent Lamp.—A translation in abstract with the illustration, of the description of the Desaymar incandescent lamp mentioned in the Digest Aug. 12.—*West Elec.*, Aug. 12.

Electric Light vs. Gas.—MARTIN.—A reprint of a paper read before the Pacific Coast Electric Transmission Association.—*El'ty*, Aug. 30.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Municipal Plant in Zurich, Switzerland.—A long, illustrated description. In the central station on the River Limmat 4350 hydraulic hp are available. Single-phase, three-phase and continuous currents are generated. The latter is used in neighboring factories, and for two of the tramway lines. The single-phase alternating current is supplied at 2000 volts to substations for public and private lighting. The three-phase current is supplied at 2000 volts to a substation, where it is transformed by three motor generators, each of 300-hp, into continuous current for another part of the tramway line; the motor parts of these machines are of the induction type and take the full 2000 volts pressure; water resistances for starting are inserted in the closed armature circuits by three slip rings on the motor shaft; the continuous current side is a four-pole dynamo, developing 360 amp. at 550 volts. The remaining portions of the municipal tramway network are fed from a separate steam-driven power house having two 60-kw dynamos and a storage battery of 300 Tudor cells of 245 amp. hours capacity. Some other tramway power houses are also described and some data are given as to the first cost.—Lond. *Elec.*, Aug. 25.

A Movable Central Station.—A short note on a carriage movable on rails and provided with a petroleum motor and a dynamo, used now by a French railway company for work in a tunnel. It is stated that the German government is also testing a similar electric generator for searchlights in war.—*L'Elec.*, July 22.

REFERENCES.

Statistics of Central Stations in Germany.—LAFFARGUE.—Two articles, one giving a summary of extended studies made by Bos and Laffargue on a special trip to Germany and described in a recently issued book; the other giving an abstract of the statistics mentioned in the Digest. Aug. 5.—*L'Ind. Elec.*, July 25.

Plymouth.—A reprint with the illustrations of the article noticed in the Digest, Sept. 2.—*Elec. Rev.*, Aug. 30.

POWER.

Electric Machine Shop.—BATHURST.—A long, well illustrated description of the new and comparatively small, but quite up-to-date machine shop of the dynamo factory of Kolben & Co., in Prague, Austria. A number of specially designed labor-saving portable tools are described and illustrated. Three-phase current power distribution is used, the whole factory being driven from a 120-hp generator. Some 50 motors from ¼ to 20-hp are used in the shops, the majority being operated at 200 volts. The shop shafting is run at 270 revolutions per minute instead of 180, as usual. The lighting can be taken direct from the power wires or from a set of accumulators which are charged from the three-phase generator by means of a rectifier of 6-kw, consisting simply of a series of contacts and collector rings, arranged on a shaft, driven by a ½-hp three-phase synchronous motor; a three-phase stationary transformer is connected to the mains and the various sections of its coils are connected to these contact rings on the shaft which are again connected to a commutator. This rectifier occupies less than 15 cubic feet of space and the loss in transformation does not exceed 5 per cent. (Mr. Kolben, the head of the firm, was formerly in the shops in Schenectady.)—Lond. *Elec. Rev.*, Aug. 18, 25.

Electric Workshop in Switzerland.—A short, well illustrated description of the Oerlikon Works, where continuous and alternating current machinery is manufactured. Except in one of the older shops, all the machine tools are driven by three-phase motors. A rough and ready electric welding apparatus for repairing slight defects in castings is said to consist of an iron or steel rod attached to one terminal of the low pressure mains, while the piece to which metal is to be added is attached to the other terminal. A method of winding transformers is noticed, with bare strip secondary coils, five copper strips bound together being employed, which method seems to offer the advantage of a large cooling surface. A short description of the power plants utilizing the water power of the Rhine falls at Schaffhausen is included.—Lond. *Elec.*, Aug. 18. A brief description of the latter, with an illustration, is reprinted in the *West. Elec.*, Sept. 2.

Electric Cranes.—A note on the workshops in Openshaw. The demand of electrically-driven cranes is said to have largely increased; three motors are usually used per crane, the type of motor being four-pole with slot wound armatures. The motors are entirely encased like tramway cars. A special feature is the automatic brake for preventing the crane from running back under load; as soon as the current is switched on to the motor it lifts the brake lever by means of an electromagnet, so that hoisting or lowering can take place without any check, when the current is switched off, the brake automatically holds the load.—Lond. *Elec. Eng.*, Aug. 25.

Rotary Transformers and Storage Batteries in Long-Distance Transmission.—SCOTT.—An abstract and criticism of Robb's recent National Electric Light Assn. paper (ELEC. WORLD AND ENG., June 10). He repeats his former remark that unless some method is adopted for greatly increasing the speed, as, for instance, his suggestion for running converters vertically (Digest, July 15), the number of poles of the rotary converter must always be very much out of proportion to the output; he claims it may perhaps be better to use instead a self-starting induction motor coupled to one of two ordinary multipolar machines. He compares the two methods of using a rotary converter running synchronously, or a self-starting induction motor coupler to two ordinary multipolar machines; the rotary converter takes up less floor space and is very little cheaper, but the other method has many advantages in other respects.—Lond. *Elec. Rev.*, Aug. 25.

Parsons Steam Turbo-Dynamos in Elberfeld.—A short note stating that two Parsons steam turbo-dynamos, each of 1000-kw, have just been completed and will be started at the end of this year in the new central station in Elberfeld, Germany. The four-pole alternators have drum armatures and make 1500 revolutions per minute, the voltage at the poles being 4000.—*Elek. Zeit.*, Aug. 17.

REFERENCES.

Electricity in Gold Mines.—TONGE.—An illustrated description of the electrical installations in the gold mining district of Cripple Creek. There are electric street cars, electric lighting, electrically-driven hoists, pumps, drills, etc.—*Eng. Mag.*, September.

Utilization of the Coke Oven Gases.—An editorial discussing the enormous waste of energy in gases from coke ovens and proposing to use it for generating electrical power by means of gas engines and transmitting it to places where it can be sold; there is a good market for power in the neighborhood of the coke regions.—*Eng. and Min. Jour.*, Aug. 26.

Electric and Hydraulic Elevators.—A short communication comparing electric with hydraulic elevators in respect to initial cost, working cost, efficiency, repairs and safety, the energy being assumed to be obtained from public supply mains in both cases.—Lond. *Elec. Eng.*, Aug. 25.

Rheinfelden.—An illustrated description of this power transmission plant referred to in the Digest, Aug. 26.—Lond. *Elec. Eng.*, Aug. 18, 25.

Power Station in Colorado.—A description of a 3000-hp power station.—*St. R'y Jour.*, September.

TRACTION.

Petro Automobile.—HOSPITALIER.—An illustrated description of an automobile which is a modification of the one of Patton, of Chicago (who uses a dynamo driven by a gasoline engine for charging accumulators which furnish the current to the electric motors coupled to the car wheels). The wheels of the Petro automobile are driven direct from a petroleum engine, and the motor dynamo combined

with an accumulator is added only for the purpose either of absorbing the excess of power or of furnishing the deficiency of power, according to whether the power required is smaller or greater than the constant power of the engine. The accumulators can therefore be built smaller and lighter and will always operate at nearly full charge, which, he says, has proved to be a very important point in the recent prize competition for accumulators. As manufactured by Pieper, this automobile has a petroleum engine of 2500 watt, which operates a dynamo-motor inserted between the engine and the driving gear of the rear wheels; the normal power of the dynamo-motor is about 1800 watts, so that it absorbs easily the total power of the petroleum engine or adds its power to that of the engines, enabling 4000 to 5000 watts to be used for traction. The battery of 40 cells has a total weight of 125-kg. The backing is accomplished by stopping the engine and reversing the current in the armature of the motor, which is purely electric. The speed of the automobile is 16 to 19 miles per hour on good roads, and is decreased to not less than 7 miles per hour on grades of 12 per cent. He speaks very favorably of this automobile which, he says, will perhaps be the vehicle of the future.—*L'Ind. Elec.*, July 25.

Accumulator Line at Bremerhaven.—Sieg.—An abstract of his recent paper. There are four motor cars and two trailers, the former weighing 7 tons and are equipped with two motors of 10-hp each; the cars run 36 miles on one charge; each battery has 86 cells of 9 plates separated by corrugated and perforated hard rubber sheets; each cell weighs complete 28-kg. From August, 1898, to March of this year 470 watt hours were required per car-km.—*St. R'y Jour.*, Int. Ed., September.

Accumulator Traction in Chicago.—A description of this 30-mile line which has been in operation 2.5 years and has already been described in the Electrical World. Each car has 72 cells and a single charge suffices for 11 miles. The life of the positive plates is about 23,000 miles. The arrangement for changing the batteries is entirely automatic and is fully illustrated.—*St. R'y Jour.*, September.

Accumulator Traction.—On two French omnibus lines traction by horses will be replaced by accumulator traction. The maximum time for charging is 50 minutes; each motor car has a weight of 13 tons, each trailer 8.3 tons. A train consisting of a motor car and a trailer consumes 27 and 21-kw hours respectively on the two lines, for a round trip. The total weight of the battery is 4.7 and 4.6 tons respectively.—*L'Elec.*, Aug. 12; more briefly in *L'Ind. Elec.*, July 25.

Electric Omnibus Traction in Berlin.—A short note stating that the General Berlin Omnibus Co. will make a trial in September of four, and later of eight, accumulator omnibuses.—*Elek. Zeit.*, Aug. 17.

Advantages of Different Systems of Electric Traction.—A. B. W. Kennedy.—A reprint in full of his report to the London County Council, concerning the best system to be adopted for the outlying portions and suburbs of London; it is based on the information obtained on a visit to Continental Europe and the United States. He favors the conduit system, as the overhead trolley system is thought to be out of the question in the busy London streets; there has not yet been enough practical experience with the surface contact system to recommend it; accumulator cars are claimed to be suitable only on level lines. Concerning the relative cost of the overhead trolley and the conduit system, he states with reference to the former that when it is "carried out as roughly as it has frequently been carried out in America, its cost is very much less than that of any underground system. Carried out as it is necessary to carry out such a system in this country, the difference of cost is not nearly so great. This difference will always, however, be considerable in cases where there are a great many pipes below the road near the surface, which have to be shifted or otherwise dealt with."—The Lond. *Elec.* and *Elec. Rev.* discuss the report editorially; the former is disappointed with the lack of accurate estimates of cost, and points out that on a great part of the suburban roads the trolley system would be eminently suitable.—Lond. *Elec.* and *Elec. Rev.*, Aug. 18; *St. R'y Jour.*, September.

London United Tramways.—A short, well illustrated description of the conduit and overhead trolley system to be used by the London United Tramway Co. The conduit system will be used within the County of London and the overhead trolley system for outside districts; to avoid interfering with the Kew Observatory an earthed return will be used; this necessitates the use of two trolleys on each car and of four overhead wires for the two tracks.—Lond. *Elec. Eng.*, Aug. 18; Lond. *Elec. Rev.*, Aug. 25; *St. R'y Jour.*, September.

Nottingham.—A reprint in full of the conclusions of the report of a committee from that city, based on a recent visit to the United States. They consider the conduit system unsuitable for that city on account of certain streets being apt to become flooded, and because the cost of installation is too high; they estimate the latter to be $60,000 per mile of single track and probably more; the traffic would not warrant this expense, and they therefore recommend the trolley system.—*St. R'y Jour.*, Int. Ed., September.

Electric Traction in Paris.—Abstracts of some articles from various French journals, on the extension of the main steam railroad lines from their present terminals into the heart of Paris, and the acquisition of new suburban connections. From the Gare d'Austerlitz the trains will be hauled in a subway to the new station by means of electric locomotives. Some extensive experiments with electric locomotives have been made on the Paris-Lyons-Mediterranean Railway; these locomotives of 45 tons weight and capable of hauling trains of 100 to 150 tons weight at speeds of 60 to 75 miles per hour, are operated by accumulators which are charged from generating stations situated on the Swiss frontier and in Haute Savoie, where abundant water power is available; the weight of the accumulators secures in this case the necessary adhesion, and the trials which have been thus far made have been most satisfactory.—*Eng. Mag.*, September.

An article on the extension of the Orleans Railway is reprinted from the *Rev. Gen. des Chem. de Fer* in *L'Elec.*, Aug. 19.

Electric Tramway Between Barmen and Elberfeld.—A short description of this double track line, 8 miles long, which is now under construction, and is the first electric railway of the Langen system (this seems to be the system in which the rail is above the car, which is suspended from the wheels). The maximum speed is 40-km per hour, which can be reached in 10 to 15 seconds; the average is 30-km per hour, including stops.—*Elek. Zeit.*, Aug. 17.

Street Railways in Germany.—An article on the condition of the German electrical industry, which has developed rapidly during the last three years. From January, 1896, to September, 1898, the electric lines have increased from 30 with 800-km, to 140 with 2000-km, and 1300-km under construction; the total output increased from 13,000 to 35,000-kw, not including 5000 from accumulators. Most of the apparatus was supplied by German manufacturers.—*St. R'y Jour.*, Int. Ed., September.

Massachusetts.—A long, well illustrated description of the ten-mile line from Dedham to Medfield, the current for which is transmitted by the three-phase system, the main station being about two miles from one of the terminals; the voltage is 2000 and the frequency 60, the transformer station being midway between the ends, and it is there reduced to 340 volts, which in a rotary converter becomes 550 volts direct current for the trolley lines. The fluctuations of the load are reduced by a 260-cell storage battery.—*St. R'y Jour.*, September.

Operating Hints.—Some practical hints in the operation of electric railways, as used at Hartford. One cut shows an apparatus for testing rail bonds; when the drop in voltage is greater than 1.5 millivolts with 100 amperes, the joint is immediately examined. The accounting methods in the storeroom and cashier's office are also discussed.—*St. R'y Jour.*, September.

REFERENCES.

Polyphase Alternating Currents for Railways.—Jackson.—An illustrated discussion of the three different system which have come into use: First, rotary transformers in auxiliary stations driven from polyphase alternators in a centrally located principal station, a continuous current distribution for the heaviest district immediately around the principal station being also maintained from it; second, polyphase alternators driven by water or steam power at an economically located principal generating station, with rotary transformers along the line to feed continuous current motors on the cars; third, the same arrangement of generating station as in the second method, but with motors on the cars.—*Cassier's Mag.*, August.

Motive Power for Tramways.—Parker.—An abstract of the paper mentioned in the Digest Aug. 5.—*Sc. Am. Sup.*, Sept. 2.

Relation Between Number of Inhabitants, Earnings and Car-Miles.—Hecker.—A statistical investigation giving these relations in the form of tables, equations and diagrams, for towns between 40,000 and 400,000 inhabitants. He claims that his investigation shows a good uniformity in these relations, which can therefore be used to advantage in projecting new tramways.—*Elek. Zeit.*, Aug. 17.

Municipal Ownership.—Taylor.—Statistics concerning the municipal ownership of tramways in Great Britain.—*Cassier's Mag.*, August.

Street Car Development.—BRILL.—An article with many good illustrations showing the development from the horse car to the electric car.—*Cassier's Mag.*, August.

Building an Electric Railway.—SERRELL.—A well illustrated outline of American requirements and practice.—*Cassier's Mag.*, August.

Overhead Wire System.—WHITE.—A well illustrated description of the overhead work.—*Cassier's Mag.*, August.

Surface Contact System.—A reprint of the illustration, with a brief description, of the one noticed in the Digest, July 29.—*West. Elec.*, Sept 2..

Conduit System.—PEARSON.—A long, well illustrated article describing the latest developments in electric conduit railways.—*Cassier's Mag.*, August.

Multiple Unit System.—SPRAGUE.—A long illustrated description of his well known system, and of the South Side Elevated Railway at Chicago, where it is in operation.—*Cassier's Mag.*, August.

Electric Locomotives.—MAIR.—A well illustrated article on the evolution of the electric locomotive and its use in underground mine haulage, in surface haulage, for factories and in installations on steam roads for handling suburban traffic and switching freight.—*Cassier's Mag.*, August.

Negative Boosters for Tramway Work.—Two short illustrated communications on boosters used in tramway work in order to "suck back" the current from the far end of the rails, and thus limit the drop in the rails, as required by the English Board of Trade.—Lond. *Elec. Eng.*, Aug. 25.

Electric Railway Motors.—HUTCHINSON.—A long, well illustrated account of the evolution of the modern electric railway motor.—*Cassier's Mag.*, August.

Rolling Stock.—UEBELACKER.—A short article on different car types for various requirements.—*Cassier's Mag.*, August.

Storage Batteries for Tramways.—LLOYD.—A well illustrated article on the use of storage batteries in the power house for regulating loads which fluctuate violently.—*Cassier's Mag.*, August.

Repair Shop Practice.—Descriptions of practical methods on the Chicago City Railway.—Another article on those used on the North Chicago street railways.—*St. R'y Jour.*, September.

Rails and Rail Joints.—BOWEN.—An illustrated article on the construction of rails and on the cast-welded joint.—*Cassier's Mag.*, August.

Electrolysis from Return Currents.—ABBOTT.—An illustrated article on the damage to underground gas and water pipes due to the return currents, and on the means of prevention.—*Cassier's Mag.*, August.

Light Electric Railways.—BELL.—An article on the economical considerations in their construction.—*Cassier's Mag.*, August.

Early Traction History.—REID.—An illustrated historical article on the development of electric traction, beginning with the year 1835.—*Cassier's Mag.*, August.

Electric Railroads in Switzerland.—LAUNAIS.—A short article giving some brief data, including the estimated costs and earnings of two projected one-meter gauge railroads, one crossing the mountains from Montreux on Geneva Lake, to Spiez on the Thum Lake at Interlaken, hydraulic power being used to generate the current. The other is a short line extending from the Jura-Simplon Railroad. —*L'Elec.*, July 29.

Trunk Railway in Switzerland.—A short description of the line from Burgdorf to Thum, referred to in the Digest, Sept. 9.—*St. R'y Jour.*, Int. Ed., September.

Electric Tramways in Great Britain.—BLACKWELL.—A well illustrated article on their present state of development. The installations mentioned and the English practice referred to have already been noticed in the Digest.—*Cassier's Mag.*, August.

Great Britain.—MCCALLUM.—A list and discussion of the principal tramway extensions which have been authorized, all of which are to be built by municipalities.—*St. R'y Jour.*, Int. Ed., September.

Electric Railway in Jamaica.—A brief description of the system of lines under construction in Kingston, Jamaica, in which water power is used as a source, the head race being a steel conduit 6200 feet long. —*West. Elec.*, Sept. 2.

Street Railways in Europe.—An article on a report to the City of Brighton which contains reports on the street railways in Rouen, Paris, Brussels, Dover, Sheffield and elsewhere.—*St. R'y Jour.*, Int. Ed., September.

Street Railways Abroad.—Brief particulars concerning the railways in 37 cities in Europe, South America and Australia.—*St. R'y Jour.*, September.

Electric Railways in America.—CLARK.—A statistical account of the rapid development of electric railways in the United States from a business standpoint.—*Cassier's Mag.*, August.

City and South London Electric Railway.—MCMAHON.—A well illustrated description of this line, referred to in the Digest June 3 and 10.—*Cassier's Mag.*, August.

Metropolitan Co.'s Station, New York.—A short description of the work on this station, with a map showing the lines operated by that company.—*St. R'y Jour.*, Sept.

Bad Aibling.—An illustrated description of the line connecting this bathing resort with a railroad 12-km distant; considerable freight is also carried.—*St. R'y Jour.*, Int. Ed., September.

Haarlem.—A brief mention of the first trolley road in Holland, 16-km in length and having 20 motor cars; it was started in July of this year.—*St. R'y Jour.*, September.

Management of Electric Automobiles.—HANCHETT.—Some general rules.—*Sc. Amer. Sup.*, Aug. 26.

Automobile Exposition.—The second part of the article mentioned in the Digest, Sept. 2, with some illustrations of electric carriages at the exposition in Paris.—*Sc. Amer. Sup.*, Sept. 2.

ELECTRO-PHYSICS AND MAGNETISM.

Quantitative Investigation of the Coherer.—TROWBRIDGE.—An interesting article giving the results of an investigation, with a bicycle ball coherer. If the static wave, induced in the coherer by the electromagnetic disturbance around it, is the cause of the lowering of the resistance of the coherer, a static discharge from a Leyden jar or electrophorus through the coherer must produce a like effect; this was verified by experiment. He then studied the lowering of the resistance as a function of the quantity of electricity discharged through it and the difference of potential on opposite sides of the coherer; his measurements are described and the results are given diagrams. For the same quantity of electricity, the greater the charging potential, the greater was the conductivity of the coherer after the discharge. The greater the charging potential, the more rapid was the rise of the conductivity per unit increase in the quantity discharged. With the coherer used he was unable to get the coherer action with 8 volts and less. With the conductivity as abscissas and the charging potentials as ordinates, the curves for various quantities of electricity cut the ordinate axis at 8.75 volts, which he calls the critical voltage peculiar to itself (he experimented with only one), a coherer with a low critical voltage being preferable for telegraphic purposes. He found that the discharge through his coherer was not periodic. He regards the coherer with its vertical wire and earth connections, as it is used by Marconi, as part of the discharge circuit of a condenser whose plates are the vertical wire and the earth; a certain potential difference between the vertical wire and the earth, is caused by the electromagnetic waves and this, with the capacity, determines the quantity of the discharge. This potential difference is an inverse function of the distance between sending and receiving stations and it must be above the critical voltage in order that the coherer action may take place; therefore if the distance is small, the sensitiveness of the coherer is increased by increasing the capacity of the vertical wire; if, however, the distance is so great that the potential is at about its critical value, an increase in capacity would lower the potential and thus destroy the sensitiveness of the coherer, which is in accordance with a statement of Marconi. Precaution must also be taken that the e. m. f. of the battery operating the relay has a value less than the critical value of the coherer. He proposes to select the critical potential of the coherer, the e. m. f. in circuit, and the sensibilities of the relay, so that the first should be higher than the second, while the third should be great enough to permit of a small absolute value of the other two.—*Am. Jour. of Sc.*, September.

Flexible Spark Discharges.—LECHER.—A description of some striking phenomena with the uni-directional spark discharges of a Wehnelt interrupter when passed through a magnetic field; they are instructive lecture room experiments for demonstrating the influence of a magnetic field on a flexible conductor. In the abstract from which this is taken two interesting experiments are described and illustrated; if the terminals are two wires hanging from the leads so that their lower ends are nearer to each other than the upper, the discharge starts at the bottom ascends under the influence of the hot air, and finally snaps at the top to begin again as before; a magnetic field at right angles to the plane of the wires greatly accelerated this, the sparks appearing to form one flaming surface; on reversing the field the discharge remains at the bottom. In the other experiments the discharge takes place between a disc and a concentric

circular wire above it; normally it passes straight from one to the other, but in the magnetic field a kind of wheel is produced, having luminous spokes which revolve rapidly in a direction determined by the sign of the field.—*Wied. Ann.*, No. 7; abstracted in Lond. *Elec.*, Aug. 18.

Spectra of Oscillating Discharges.—Hemsalech.—In a former investigation made together with Schuster, he had found that if self-induction is introduced into the discharge circuit of a condenser, the spectrum of the spark discharge has certain properties which place it midway between the ordinary spark and the electric arc; the lines of the metal composing the spark gap stand out sharp and clear, and the lines due to the gas disappear. In a recent continuation of this investigation he found that by using different inductances, from small to large, a nearly continuous transition from the ordinary spark to the arc spectrum can be obtained. As the higher inductances necessitate longer exposures, the lines due to the gases appear again in the photographic spectra. As a general rule, the high temperature or "short" rays tend to disappear as the inductance is increased, while the low temperature or "long" rays either remain unchanged or become brighter and sharper.—*Comptes Rendus*, July 31; abstracted in Lond. *Elec.*, Aug. 18.

Energy in a Spark Gap.—Riecke.—By using a Toepler influence machine, driven by a motor at a constant speed, of 13 turns per second, the watts per turn were found to be as follows for the various lengths of spark gap: 1.64 watts for a gap of 2-cm, 2.08 for 4-cm, 1.79 for 8-cm. The work, as is seen, diminishes if the spark gap is increased from 6 to 8-cm, and as the pressure increases at the same time, the quantity of electricity discharged is less, which is obvious from the appearance of the sparks.—*Wied. Ann.*, No. 8; abstracted in Lond. *Elec.*, Aug. 25.

Potential Gradient at the Anode in Vacuum Tubes.—Skinner.—An investigation of the potential gradient within the luminous layer of 1 to 2-mm thickness covering and closely adhering to the anode. Both Hittorf and Graham (Digest, March 26, 1898) had found that there is a sudden fall of potential between the metallic anode and the gas, amounting to about 20 volts and increasing to about 40 volts within the first few millimeters. Skinner proves that the potential gradient within the luminous layer is infinitesimal, and that the greater the potential drop at the anode, the thicker is the anode layer. The anode drop depends upon the gas, the pressure, and the material of the anode; it has the greatest values for those metals which exhibit the least difference of potential when used as cathodes.—*Wied. Ann.*, No. 8; abstracted in Lond. *Elec.*, Aug. 25.

Diffraction of Röntgen Rays.—Maier.—An account of a series of experiments made to determine the wave length of Röntgen rays by means of diffraction. In the course of an investigation made for the same purpose Fomm had used a linear source of Röntgen rays, a slit parallel to it, and a screen behind the slit, on which he detected two systems of fringes, one on each side of the slit, and one system in the image itself. In trying to repeat this experiment Maier used every variety of focus tube and altered the elements of the arrangement in every conceivable manner, but without success; but when he used ordinary Crookes or Hittorf tubes, be obtained the fringes sought, or rather the first minimum within the image. From his measurements he calculated the wave length to be about a thirtieth of the wave length of ordinary light, which is good agreement with Fomm's figures.—*Wied. Ann.*, No. 8; abstracted in Lond. *Elec.*, Aug. 25.

Cathode and Canal Rays.—Berg.—In agreement with Wehnelt (Digest, April 22) and others, he thinks that Goldstein's "canal rays," obtained by using a perforated cathode, are nothing but anode rays conveying a positive charge; he investigated the converse phenomenon when the anode is perforated. There are some important differences between the two phenomena.—*Wied. Ann.*, No. 8; abstracted in Lond. *Elec.*, Aug. 25.

A New Radio-Active Substance.—De Haen.—By extraction from a large quantity of uranium ore, he has obtained substances which possess the properties ascribed by Curie (Digest, Feb. 4) to "radium," in an extraordinary degree. Two preparations have been made; one exhibits the properties of Becquerel rays, it excites fluorescence in a barium platino cyanide screen even across opaque substances, effects the photographic plate, makes air electrically conducting, and is itself strongly luminous. For the other preparation the excitement of the screen is more intense, whereas the self-luminosity is feebler. Both must be carefully protected from moisture.—*Wied. Ann.*, No. 8; abstracted in Lond. *Elec.*, Aug. 25.

Cosmical Magnetism and Electricity.—Cotterell.—An article giving in a series of diagrams, the various positions occupied by the terrestrial magnetic axis in relation to the sun at various times of the day, in comparison with the phases of the Atlantic earth current effects as observed by Raymond-Barker (Digest, July 15) at the American end of Atlantic cable. He finds a striking coincidence of the phases and shows a most intimate "magnetic electric relation" between the sun and the earth.—Lond. *Elec. Rev.*, Aug. 25.

REFERENCES.

Velocity of Electric Waves.—Gutton.—A reprint in abstract of the article mentioned in the Digest, July 29.—*L'Ind. Elec.*, July 25.

Action of the Coherer.—Tommasina.—A full reprint of his note abstracted in the Digest, Aug. 26.—*L'Elec.*, Aug. 5; an abstract appeared in *L'Ind. Elec.*, July 25, and a translation in *West. Elec.*, Sept. 2.

High Frequency Point Discharges.—Himstedt.—An abstract of the article noticed in the Digest, July 22.—*Elek. Zeit.*, Aug. 17.

Globular Discharge.—Leduc.—A reprint of the short Academy paper mentioned in the Digest, Sept. 2.—*L'Elec.*, July 29; *L'Ind. Elec.*, July 25.

Electrolysis Induced by Röntgen Tubes.—Bordier and Salvador.—A reprint in full of the paper abstracted in the Digest, July 29.—*L'Ind. Elec.*, July 25.

Pressure and X-Ray Ionization.—Hillers.—An abstract of the article noticed in the Digest, Aug. 5.— *Elek. Zeit.*, Aug. 17.

Thermo-Electricity.—Liebenow.—An abstract of the article noticed in the Digest, July 29.—*Elek. Zeit.*, Aug. 17.

The Field of Experimental Research.—Elihu Thomson.—An address of general character, read before the American Association for the Advancement of Science.—*Science*, Aug. 25; *Elec. Rev.*, Aug. 30; *El'ty*, Sept. 6.

E. M. F. of Magnetized Flames.—Blondlot.—A full reprint of his short note, abstracted in the Digest, July 29.—*L'Ind. Elec.*, July 25.

Magnetic Properties of Iron Ores.—Abt.—An investigation of the magnetic properties of hematite, in comparison with magnetite and pyrrhotite.—*Wied. Ann.*, No. 8; abstracted in Lond. *Elec.*, Aug. 25.

Steel for Magnets.—Osmond.—The complete paper which was abstracted in the Digest, July 29.—*L'Ind. Elec.*, July 25, and *L'Elec.*, July 15.

Units, Measurements and Instruments.

Measuring the Frequency.—Zenneck.—An illustrated description of a very accurate method of measuring the variation of the frequency of alternating currents by means of a Braun cathode ray tube (Digest, July 30, 1898). If a small beam of cathode rays strikes a fluorescent plate at the end of the vacuum tube, an illuminated point is produced, which in general is in the middle of the plate; if the cathode rays are deflected by a magnet, the illuminated point is deflected perpendicularly to the direction of the magnetic field; if a rotary magnetic field is produced, the illuminated point travels around in a circle producing an illuminated ring. This is strictly correct only, if the alternating current producing the rotary magnetic field is a pure sine wave and if the cathode rays are produced continually by continuous discharges; if, however, the alternating current is not a strict sine wave, a combination of a circular line with an added sine wave is produced; the description of a method to find the ratio of the amplitude of the main overtone to that of the fundamental wave by means of this image, is promised. If, however, the alternating current is a pure sine wave of the frequency n and the production of the cathode rays is interrupted by periodically interrupted discharges of the frequency $2n$, two illuminated points are seen, the terminals of a diameter of the former circular ring. If the frequency of the alternating current is slightly increased, these points are deflected in the direction of rotation of the field, and vice versa. If the speed of revolution of the field is changed by one revolution, the points travel through the whole circular line. Up to five revolutions of these illuminated points a second, can be observed, and a change of the frequency of the field up to five (complete cycles per second) can therefore be measured. The illumination of the tube is produced by an induction coil, the primary current of which is interrupted by a weighted fork, the weights on the prongs being adjustable. He claims that his method is the most accurate to be had and even superior to the acoustic method of observing the beats or fluctuations of sounds (such as in the interesting method of Smith, described in the Digest, Aug. 19).—*Elek. Zeit.*, Aug. 17.

REFERENCES.

Registering Galvanometer.—A long, well illustrated description of a registering galvanometer with relay, devised by Callender. It re-

cords graphically the variations of the different physical quantities which can be deduced from a measurement of resistance, or potential difference; it can be used to draw the curve of the variations of temperature of a furnace for the preparation of steel or that of the consumption of electric energy in a distribution network.—*L'Elec.*, Aug. 12.

Resistance Boxes.—FEUSSNER.—A long, illustrated paper read before the German Electrotechnical Society, giving descriptions of some new types of resistance boxes for small currents, which can be used at the same time as measuring and as regulating resistances. As a general rule, it can be said that the power consumed in a coil should not exceed one watt, in order to avoid the danger due to heating. For higher currents separate apparatus are necessary for regulating and for measuring; a description of such apparatus is promised.—*Elek. Zeit.*, Aug. 24.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Compensating Condensers in Telegraph Circuits.—SIMPSON.—A mathematical investigation showing that if in a circuit of resistance and self-induction the source of e. m. f. is suddenly removed, the current does not disappear at once, but can be compensated by an equal and opposite current, by connecting, in series, a non-inductive resistance which is shunted by a capacity. He calculates the values of the non-inductive resistance and the capacity necessary in the case of a telegraphic circuit in order to cause the current in a given relay to disappear immediately on the sudden removal of the e. m. f. In an editorial note it is pointed out that Muirhead has found that an inductive shunt on the receiving instrument has much the same effect as the arrangement proposed by Simpson, but that both arrangements will probably not prove to be of practical value for submarine cable telegraphy, as the value of Simpson's shunted condenser as well as that of Muirhead's inductive shunt would have to be altered for every different circuit and for every variation in the speed of signaling.—Lond. *Elec.*, Aug. 25.

REFERENCES.

Trans-African Telegraph.—A note on the progress of the trans-African telegraph line. The construction of the line to the north is now completed to a point close to the south end of Lake Tanganyika. —Lond. *Elec.*, Aug. 18.

Privacy of Telephone Communications.—CLAUSEN.—The first of a series of illustrated articles "discussing the methods employed by eavesdroppers and means for detecting their presence 'on a wire.' "—*West. Elec.*, Sept. 2.

Wireless Telegraphy.—DARY.—An article of a general character on the present state of the art.—*L'Elec.*, July 29.

New Books.

ELECTROMAGNETIC THEORY. By Oliver Heaviside. Volume II. London: The Electrician Printing and Publishing Company, Limited. 542 pages, 46 diagrams. Price, $5.00.

The first volume of this work was published five years ago, and was reviewed in the ELECTRICAL WORLD of Nov. 3, 1894. The electrical profession will certainly be glad that the second volume has at last appeared. The style is like that of the preceding volume, only a little more polemical if anything. As before, Mr. Heaviside has plenty of spice for those who do not treat his theories and discoveries with the respect to which they are entitled; but there is less cause for it now than before, for the author himself says that the things for which he most strongly contended have won the day. His predictions relating to skin conduction and to distortionless circuits as affecting the possibilities of long distance telephony, have been verified, and his own position in regard to these points vindicated in a manner entirely satisfactory to himself.

There is no index to the book, which is a pity, as a table of contents is entirely inadequate for the purpose of finding particular references in a work of this character. The volume begins with Chapter V, which is entitled "Mathematics and the Age of the Earth." This title does not appear exactly germane to the subject of the book, but its introduction is justified on the ground that the solution of the problem of radiation of heat from the earth leads to the solution of similar problems in electrical theory. But when the author takes occasion in this chapter to say that he believes in Topsy's theory of the origin of life, which he says is also Tyndall's theory, we wonder what connection, direct or indirect, this statement has with electromagnetic theory. A better title for the book would be the one so popular in the days when all scientific works were written in Latin: "De Natura Rerum." ("Of the Nature of Things.") A still more descriptive title, taking the work as a whole, would be "What I know about Mathematics, and what I think about Mathematical Purists, more especially the Cantabrigian Species."

We do not in any way wish to belittle Mr. Heaviside's work; his really valuable discoveries are beginning to receive the recognition which they deserve, and will receive more as the years go by, but we do not think the lustre of his discoveries would be at all dimmed were he less proficient in the art of scolding.

His position regarding the use of mathematics and the value of mathematical reasoning may also appear to some rather anomalous. In the first volume he defended mathematical reasoning in a manner which commends itself to even Cantabrigian purists, his argument being that like all correct reasoning, mathematical processes will produce no result not implicitly contained in the premises. Now he finds fault with the purists because they insist upon everything being strictly logical. Euclid is tediously logical, and it now transpires that this is Mr. Heaviside's objection to him, and the reason why he calls the study of Euclid barbarous. Perhaps logic is one of the characteristics of barbarians. If so, we have a new criterion by which to judge the progress of a nation in civilization.

Mr. Heaviside says in his first volume "all reasoning must be in a sense, mechanical, else it is not sound reasoning at all, but vitiated by fancy. Mathematical reasoning is, fundamentally, not different from reasoning in general." With these sentiments we heartily agree, and add that in order to show this mechanical quality of all correct reasoning, Jevons constructed a logical machine, into which one can introduce the premises of any logical proposition (when put in the proper formal manner) and by operating the mechanism, all the legitimate conclusions therefrom appear at the proper place. If the premises contain a contradiction, the machine refuses to operate. Now, turning to the present volume, we find the heading to section 224 (the second section of the volume) is "Rigorous Mathematics is Narrow, Physical Mathematics Bold and Broad." The narrowness spoken of is the very mechanical quality last mentioned, which does not allow "any results that are not implicitly contained in the material with which you work." Mr. Heaviside quotes Lord Rayleigh in support of his view, though on reading the quotation we do not receive exactly the same impression as from the author's own words. We will, therefore, endeavor to make it plain exactly what the author does mean.

The first statement in the book is that mathematics is an experimental science. To this we agree, in the sense in which the author means it; that is, physics (and for that matter all sorts of everyday experiences), originally suggest problems, the solutions of which, arrived at partly by guess work at first, finally become by successive improvements perfectly rigorous mathematical processes. But even purists know this; at all events, if they do not all know it in general, they at least know it in particular cases, as, for example, John Bernoulli's physical problem which resulted in the invention of the calculus of variations. This, then, is not the bone of contention between Mr. Heaviside and the purist from Cambridge, but we find just where the shoe pinches by reading a little further.

Mr. Heaviside has a method of solving difficult problems which he calls the operational method, and which, although it seems to be fruitful of results in his hands, lacks something of mathematical rigor in demonstration. The purists naturally object to this sort of mathematics, and Mr. Heaviside being naturally attached to a method of his own contrivance that yields results with great facility, even if they are somewhat open to criticism, champions its cause so vigorously that he goes somewhat beyond the bounds of sober argument and says in effect that he prefers his mathematics not too rigorous. Too much demonstration is dry and tedious, as it leaves no room for "imagination." We agree with Mr. Heaviside that a method which solves problems, even though not quite rigorous, and therefore liable to give some incorrect results, is more useful than a perfectly rigorous method which will not solve the problems, but further than this we do not agree with him.

Mr. Heaviside's position in the mathematical world is somewhat difficult to define in a manner that is comprehensible to those who are not well read in mathematics, but a comparison between it and those of prominent men in other departments of intellecual working may be of some service. In some respects, at least, there is

a strong resemblance between Mr. Heaviside in mathematics, Walt Whitman in poetry and Wagner in music. In all there is great originality coupled with an impatience of restraint which leads to grotesque exaggeration and a morbid delight in the violation of all the accepted rules. Whitman has produced something absolutely original; but then his product is neither poetry nor prose, notwithstanding that his admirers rate him as the poet of the ages. Likewise, though Wagner is classed by his followers as the greatest musician of all time, the opposite school of critics say that he did not write music at all when he gave his own peculiar ideas full sway.

It is not, however, by these aggressively prominent characteristics that the present volume should be judged, but rather by the real contributions to science which lie beneath the surface and which can only be reached by some digging.

PRACTICAL ELECTRICITY. With Questions and Answers. By J. C. Lincoln. Cleveland: Cleveland Armature Works. 286 pages, 83 illustrations. Price, $2.

This little book is written especially to assist those who have some practical knowledge of electricity, and who wish to learn something concerning the technical side of the science as met with in everyday work. The first chapter is on the calculation of wiring; the second on electric batteries and electroplating, and the next four on magnetism in the magnetic circuit. Among the subjects treated in the remaining chapters are the calculation of field coils and armature windings, dynamo and motor connections, hysteresis and eddy currents, armature reaction and sparking. Alternating currents are treated in the final chapter. One of the features of the book consists in the addition to each chapter of a large number of questions on the topics treated therein, answers to which questions are given at the end of the book. The book is neatly printed in pocket form, with colored edges, and flexible, strong cover.

BOOKS RECEIVED.

TRANSACTIONS OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Published by the Institute. Vol. XV. 1898. 812 pages, numerous illustrations. Price, $5.00.

Convention of the National Association of Municipal Electricians.

CAPT. WM. BROPHY.

The fourth annual convention of the National Association of Municipal Electricians, the opening sessions of which were noticed in our issue of last week, adjourned on Thursday, Sept. 7, after a successful meeting with respect to papers read, attendance and interest manifested. The attendance, including supply men, numbered in the neighborhood of 100, and many of the delegates were accompanied by their wives. There were about two score manufacturers and others represented in the electrical exhibition, which proved to be such a successful feature that it will be repeated at Pittsburg, next year.

At the final meeting on Thursday a large number of new members was elected. N. W. Bethune, superintendent of the Grand Northwest Telephone Company; Thomas Ahearn and Peter Provost, all of Ottawa, Canada; and M. J. O'Leary, of New York, were elected honorary members. Mr. Frank C. Mason, of Brooklyn, was elected delegate to represent the Association at the Paris Electrical Exposition. The following officers for the ensuing year were chosen:

President, Capt. William Brophy, Boston, Mass.; vice-president, G. F. McDonald, Ottawa, Canada; secretary, Henry Cottell, Boston; treasurer, Adam Bosch, Newark, N. J.; financial secretary, Barrett McAllister, Bradford, Pa. Executive committee: Morris W. Mead, Pittsburg, chairman; William Y. Ellett, Elmira; J. W. Aydon, Wilmington, Del.; F. C. Mason, Brooklyn; Frank G. Boyd, Baltimore. Pittsburg was named as the place of meeting next year of the fifth annual convention.

The retiring president, Mr. J. W. Aydon, in his address, referred to the enormous consequences which have followed from the invention of the telegraph which opened up a new field of industry and in a sense prepared the way for the enormous electrical development of to-day. A glowing tribute was paid to Morse, Bell and Edison, and credit given to the others who have taken a leading part in the several branches of electrical development. The work of Channing, Farmer and Gamewell, which led to the present system of municipal fire protection by electrical signaling, was sketched. The Montauk multiphase cable he referred to as the last and greatest achievement of the electrical age, "which, being operated under a natural law of the Creator, may be considered one of His highest and best gifts."

Mr. Morris W. Mead, of Pittsburg, in a strong paper, advocated the concentration of all municipal electrical interests under one head. In the City of Pittsburg, he stated, there has been a concentration of control and individual responsibility in municipal electrical matters from the beginning. Commencing originally with the fire alarm telegraph, the police telegraph when adopted was put under the same control, and when the sudden development of electric street railways demanded its supervision for the safety of the public, the execution of ordinances, in so far as they dealt with the electrical apparatus, was vested in the same bureau. When the rapid extension of electric lighting in private houses made it essential that there should be some oversight of it in the public interest, the duties of inspection and supervision were added to the same office. Finally, when the underground ordinances were passed, compelling all companies to place their wires beneath the surface of the earth, the duty of looking after the overhead wires and compelling their removal was delegated to the same head. Mr. Mead said that, speaking from an experience of working for twenty years as the controlling head of this branch of municipal work in Pittsburg, he cannot conceive of doing business successfully under any other system. He believes that any man qualified to administer one branch of electrical work should be fitted to administer all the cognate branches. Among the advantages of concentration is that if anything goes wrong in one department, the entire force employed may be utilized in setting it right. For example, if there is a break in the police wires, the fire department men may be called upon at any hour of the day or night without recourse to the red tape necessitated in hunting up a department authority and getting permission; or if live wires cross each other by accident and one of them does damage, there ought not to be two chiefs of different bureaus with equal authorities to fix the blame or estimate the loss.

Mr. W. H. Thompson, of Richmond, Va., read a paper on "Overhead Construction," in which much stress was laid upon the desirability of selecting the best material, no matter whether the line is to be a permanent one or one run only for temporary purposes. Should it, however, be impossible to use the best of everything for both outside and inside, the retrenchment should apply to the inside work rather than the outside, for the reason that trouble may be more easily located in the interior than over a long length of line outside. While cedar and live chestnut poles are mostly used for line work, a great many of pine, cypress and other woods are also employed, depending in a great measure upon the kind of line and the number of wires to be placed on the poles. For instance, a white cedar pole would hardly answer for a line of heavy electric light and power wires, although it would probably meet every requirement for a small telephone exchange. In Richmond, specifications for chestnut poles require that they shall be of the best quality of live chestnut, squared at both ends, reasonably straight and well proportioned from butt to top, not trimmed close and of the following dimensions:—

Length.	Circumference at top.	Circumference, 6 ft. from bottom, not less than
30 feet.	22 inches.	36 inches.
35 "	22 "	40 "
40 "	22 "	43 "
45 "	22 "	47 "
50 "	22 "	50 "
55 "	22 "	53 "
60 "	22 "	56 "

Pine and cypress cross-arms are mostly used and are required to be free from such sap and knots as would weaken them, and be thoroughly seasoned. They are 6 feet long, 3¼ inches thick and 4¼ inches deep. The guy stubs and anchor logs are made of the

same material as the pole and should come up to the same requirements; the former should have not less than 20 inches circumference at the top and the anchors should have not less than 28 inches circumference and not less than 5 feet length. All the metal work on the pole or attached to it should be thoroughly galvanized. Cross-arms are placed 24 inches apart measured from the centres, and secured to the pole by a single ⅝-inch bolt running from the back of the pole through the centre of both gain and cross-arm. On all straight lines where the distance between the poles is equal, the cross-arms should be placed on the alternate sides of the pole.

Mr. G. F. McDonald read a paper on "Progress and Development of the Fire Alarm and Police Telegraph in the Dominion of Canada." The first alarm and police telegraph in Canada was established in Montreal in 1863, with 53 boxes and special instruments for police purposes. At present, Montreal has 255 alarm boxes, and a modern police alarm on street corners was introduced in 1884. Toronto installed a fire alarm system in 1871 with forty boxes, and to-day has 183 boxes with 10 circuits, and one of the most complete telegraph and underground systems in existence. The following are fire alarm statistics of other cities: Quebec started in 1857 with 53 boxes, to-day has 100; St. Johns increased from 25 boxes in 1867 to 61 to-day; Ottawa, 30 boxes in 1874, has 100 at present. Montreal and Toronto are the only Canadian cities having an efficient police patrol alarm system.

Capt. William Brophy, of Boston, read a paper on "Licensing Employees on Electrical Work and Improving the Quality of Work and Material." After pointing out the possible dangers resulting from the generation and distribution of high-potential currents, and also of currents of lower potential but of large volume, he spoke of the benefit derived from the system of licensing established by the New England Electric Exchange. This organization established a system of examining boards which issue licenses to those who successfully pass an examination as to their qualifications for electrical work. These certificates have proved of much value to the holders, as nearly all of the officers of electric light, railway and power companies and contractors require their employees to appear before the examining boards and obtain one of the licenses in order to remain in their employ; and, as a rule, the holders of the license are sought for in preference to others. There are five classes of licenses, ranging from a first-class license issued to those possessing the qualifications for the position of superintendent of electric lighting and street railway plants, to a fifth-class license issued to persons competent only to operate electrical machinery and not competent to do electric wiring. All licenses are valid for one year from date, but the licensee can apply within that time for examination for a license of a higher class, or renew the original one upon its expiration.

A paper on the "History of the Police Telegraph System" was read by Mr. John Weigel, of Boston. This system, he stated, dates back to the early days of fire alarm system, for it was customary in those days to have a special call which could be used by the police department in case of emergency, a certain signal by the fire alarm indicating that all policemen must immediately report for orders. The development of the police telegraph was followed from this period to the present.

Mr. Thomas W. Flood, Wire Commissioner, of Boston, in a paper, gave an account of the laws and government of the wire department of Boston. He favored the centralization of power in wire departments under one bureau, and spoke of the excellent work which had been accomplished by the wire inspectors in Boston. There was a time when shoddy material and poor work was done in that city, but the concerns which formerly did such work there are no longer in business.

The list of attendants comprised, among others, the following: New York, C. O. Baker, Jr., William C. Callmann, T. J. Smith, F. W. Harrington, Edward Baines, Ditman Fisher, E. E. Pierce, George T. Manson, Fred Hendey, A. P. Eckert, Marcus Nathan, G. F. Porter, G. L. Wiley, C. W. Price, Frederick Pearce, Alexander Henderson, M. J. O'Leary, Charles W. Price, J. B. Taltavall, Frank L. Perry, W. L. Candee, B. F. Gilkison, J. W. Stover and J. Jones, Jr.; Boston, F. W. Ferin, A. S. Clark, John Weigel, Thomas W. Flood, John D. Cornady, William Brophy; Brooklyn, Newton H. Murphy, Michael E. Dougherty, W. A. Cooper, John Speicher, Frank C. Mason; Baltimore, S. A. Williams, F. G. Boyd; Minneapolis, Charles K. Pillsbury, Z. L. Morrison; Bridgeport, Conn., William A. Barnes; Elmira, N. Y., Albert Bunday, W. Y. Ellet; Chicago, Charles A. Rolfe; Savannah, Ga., W. D. Claiborne; Ottawa, Ont., G. F. Macdonald; Paterson, N. J., J. F. Zeluff; Newark, N. J., Adam Bosch; New Britain, Conn., Capt. T. H. Brady, George Cooley; Pittsburg, Pa., Morris W. Mead; Utica, N. Y., G. F. Breitenstein; Peoria, Ill.; F. L. Michael; Corning, N. Y., F. P. Foster; New Brunswick, N. J., Charles Greenwalt; Charleston, S. C., Lon Simmons and Arthur R. Rhett; Richmond, Va., W. H. Thompson, H. T. Simpson; Trenton, N. J., U. G. Quigley; Chester, Pa., W. S. Sykes; Bradford, Pa., B. McAllister; Erie, Pa., William Crane and W. C. Mourey; Grand Rapids, Mich., M. G. Canfield; Orange, N. J., W. S. Logue; Toledo, O., J. T. Green; New Haven, Conn., James Grant; Newcastle, Pa., Mr. Alexander; Salt Lake City, Utah, Charles T. Vail; Harrisburg, Pa., C. E. Diedl.

ELECTRICAL EXHIBITS AT THE WILMINGTON CONVENTION

This year's convention of the National Association of Municipal Electricians was the first to have an exhibition of apparatus and material in connection therewith, and the interest thus added was so manifest that the same feature will be repeated at next year's convention in Pittsburg.

The Western Union and Postal Telegraph Companies each exhibited a completely equipped telegraph office in working operation, and the local Bell Telephone Company showed a fully equipped local and long distance telephone station. The Gamewell Fire Alarm Telegraph Company had on view a complete central office outfit for a police telegraph system; police and fire alarm signal boxes, showing latest improvements; a complete patrol wagon-house outfit; and a working exhibit of the auxiliary fire alarm telegraph system. The Montauk Multiphase Cable Company, New York, had on view a complete working exhibit, presenting a section of a dwelling in which was shown the application of the Montauk cable for instantaneous fire detection. This exhibit is to constitute a portion of the one to be made by this company at Paris. Mr. C. W. Price was in charge.

Of wire manufacturers, the Okonite Company, New York, showed a full line of its products, consisting of insulated wires and cables for aerial and submarine work, "Okonite" and "Manson" tape and "Candee" weather-proof wires. Mr. W. L. Candee and Mr. G. T. Manson were in charge. William R. Brixey, New York, had an exhibit embracing the "Day's Kerite" products of insulated wires and cables for aerial, underground, submarine and interior use; wires especially adapted for police and telegraph uses, and the Kerite tape. Mr. George F. Porter represented the company. The Standard Underground Cable Company, Pittsburg, had a well-arranged display of rubber, paper and fibre insulated wire, underground, submarine and aerial cables. A neat button souvenir showing the head of President Aydon was distributed from this booth. Mr. G. L. Wiley and Mr. J. E. Hughes were in charge. The Safety Insulated Wire & Cable Company, New York, had an exhibit arranged on a mahogany board 8 feet long, showing samples of both cross and lengthwise sections of the Safety products, including underground, aerial, submarine cables, etc. Samples of some of the cables furnished in recent work, embracing that supplied for use in the Philippines, were also shown. Mr. A. P. Eckert was the representative present. The National India Rubber Company, Bristol, R. I., was unable to get its exhibit ready, and utilized its space by placing a sign therein referring to its various wire and cable specialties, etc. Mr. Henry D. Stanley represented the company. The American Circular Loom Company and F. M. Ferrin had a joint exhibit, representing an attractive arrangement of wire products, in which aerial, underground and submarine cables suitable especially for municipal purposes were displayed. Mr. F. M. Ferrin was in charge.

Primary batteries were exhibited by several firms. The Gordon Battery Company, N. Y., had a display of the Gordon primary cells and their method of adaptation to open circuit work in connection with fire alarm systems. Mr. William C. Banks was in charge. William Roche, New York, showed the "New Standard Dry Battery" in a variety of sizes. An electrical scarf-pin, fitted with the smallest dry battery ever made, was also shown. Baines' Improved Primary Battery Company, New York, presented a new battery particularly designed for use in connection with the telegraph and fire alarm systems. Mr. William C. Callmann and Mr. Edward Baines were the representatives present.

Among other exhibitors were the following: The Shelby Electric Company, Shelby, O., which showed incandescent lamps and electrical novelties. Machado & Roller, New York, whose exhibit was shown in connection with the battery display of William

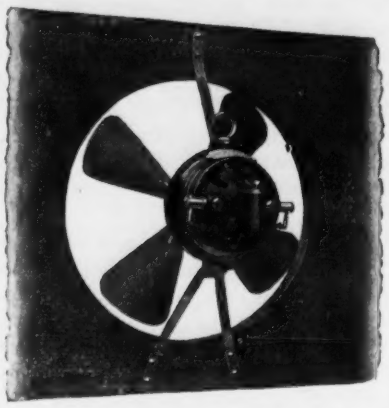
Roche. It included a full line of Whitney measuring instruments, of which this firm is exclusive selling agent. Frederick Pearce, New York, had an exhibit made up of electric turn tables, designed for facilitating display in store windows, etc., together with fire and police telegraph supplies. A stick-pin souvenir showing bust of President Aydon was distributed. Mr. Frederick Pearce was present to receive his friends. The Manufacturers' & Inventors' Electric Company, New York, showed a number of electric specialties, including general telegraphic apparatus, electrical test apparatus, the telegraphers' Morse watch, electrical fans, talking machines, and Morsegrams. The Kings County Electric Equipment Company, Brooklyn, Mr. H. B. Mason in charge, had on display electrical supplies for fire and police telegraph systems, burglar and fire alarms, electric fans and electric lamps. The C. A. Rolfe Electric Company, Chicago, showed the Rolfe device for protecting telegraph, fire alarm, police telegraph and telephone against currents, the inventor, Mr. C. A. Rolfe, being in charge.

Twenty-First Annual Clambake of the American Electrical Works.

It was befitting the twenty-first annual clambake tendered by Mr. Eugene Phillips, of the American Electrical Works, of Phillipsdale, R. I., to the electrical fraternity, that it should be the best attended in point of numbers of all the entertainments. It might be said that these clambakes, which have become so popular among Mr. Phillips' friends, had now attained their majority, and every one who could possibly attend got there somehow or other, and from all parts of the United States. It is almost needless to say that the weather was perfect—it always is perfect on these occasions—and every one who was there had a royal good time. It could not be otherwise, as everything in the way of entertainment was provided. The baseball enthusiasts played their annual game, and, strange to say, the umpire was not seriously hurt, though many imprecations were hurled at his devoted head, not perhaps undeservedly, as some of the decisions were evidently given darkly as seen through thick clouds of smoke furnished by one of Mr. Phillips' cigars. The New York contingent, as usual, played the Boston players, but the writer was totally unable to find out which of the teams won, though it took no great amount of perspicacity to discover that both sides claimed the victory. The bowlers also had a most exciting time, and one could almost see a broad grin on the face of the pins as the balls rolled harmelessly past and could hear a whispered comment which to the initiated in such language sounded suspiciously like "Never touched me." Quoits were also indulged in, and football, which gave vent to much of the suppressed energy in this direction which electrical men are well known to possess. The usual lunch was served punctually at 11:30, and a most animated photograph was taken just previous to the serious business of the day. Promptly at two o'clock the guests to the number of 360 sat down to the regular clam dinner, and it did seem as if the chowder was just a little more enticing, the crabs were a little crisper, the clams a little more succulent and the watermelon a little more juicy than on any of the twenty previous occasions. Mr. Eugene Phillips occupied the head of the centre table as usual, and had an able toastmaster in Mr. R. S. Brown, of the Westinghouse Company, who is always a welcome addition to a function of this kind. In his usual happy and genial manner Mr. Phillips welcomed his guests, reminding them that this was the twenty-first of the dinners, and that he wanted them all to consider themselves as members of "our family" and that it appeared to him like the family gathering that usually takes place at the coming of age. Congressman Capron made some very happy and humorous remarks, and wound up with a stirring appeal to all regardless of their politics to stand behind the government at this crucial period in its history. Mr. Wardell, of New York, gave in his inimitable way a number of interesting recitations, and Mr. W. H. Harding, and Mr. Frank Rillin, of Boston, concluded the exercises. It has only to be added that the menu was printed on sheet copper, the corners of which were neatly bound to paper covers by scroll copper frames, and that the souvenir this year was a handsome silver loving cup of unique design and pleasing appearance. Needless to say that at the close of the speeches Mr. Phillips was accorded a most enthusiastic tribute of thanks, after which the guests scattered slowly for their several destinations, and a most agreeable and enjoyable day was completed.

A. C. S.

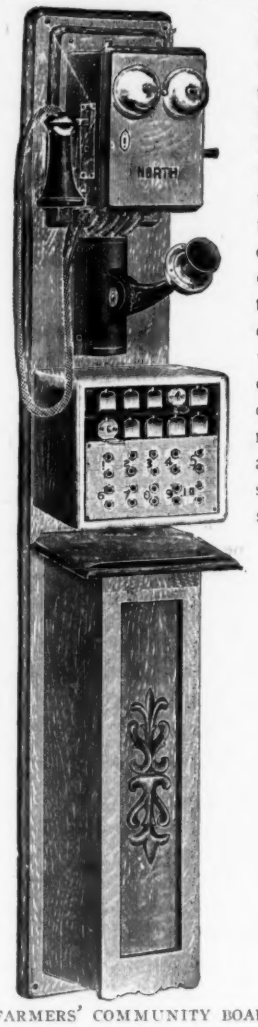
Fan Motor Attachment.



A very convenient application of small fan motors to the work of ventilating is shown in the accompanying illustration. A Lundell fan motor with the base removed is mounted by means of a tripod on a board in which a circular opening may be made of the same approximate diameter as the fan's blades, and the board may be cut to fit the top or bottom of a window. A small switch is furnished by which the speed can be suitably controlled, the switch, of course, being located wherever desirable. Special spoon shaped blades are supplied with these outfits. The extreme simplicity of this apparatus, made by the Sprague Electric Company, recommends it for use in offices, churches, hospitals, residences, etc., where its installation will do much to mitigate the discomfort of vitiated air and at a very small expense.

Community Telephone Exchanges for Farmers.

One of the most interesting features of the development of "independent" telephony has been the extension of the benefits of the telephone to the inhabitants of rural districts who were either too scattered and isolated to form even a village exchange or were unwilling and unable to pay the rates demanded. How best to work out the newer conditions of farmers' exchanges so as to make them successful and profitable has been a matter of close study, and some noteworthy advances are being made. The North Electric Company, of Cleveland, O., has recently brought out a system which it calls the Farmers' Community Exchange, intended to meet all the difficulties of the case, and the features of its plant are herewith illustrated. This system, as the accompanying chart shows, comprises the location of small exchanges at various centres surrounding the city and radiating therefrom lines which connect to the various farmers in that vicinity, and connecting each "community exchange" by a trunk line to the nearest city exchange. In but one of the community exchanges are there shown the lines and method of connecting in the various subscribers' stations, but it is easily seen that if similar distribution of



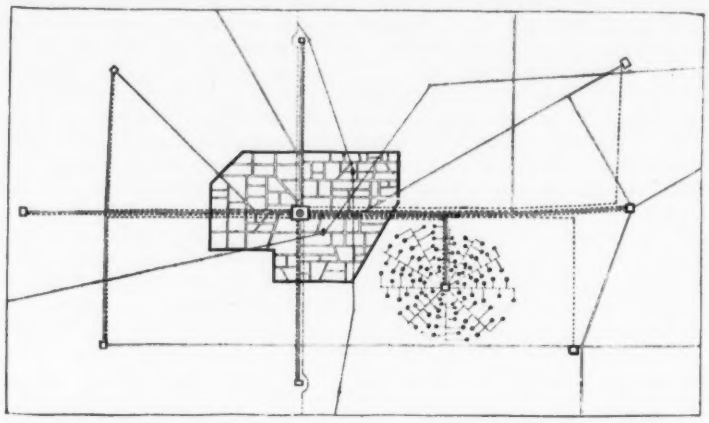
FARMERS' COMMUNITY BOARD.

NORTH REPEATING COIL.

lines from the various community exchanges is made the entire farmers' community contiguous to the city is thoroughly served. In the chart or diagram, the city exchange is indicated by the square at the centre, while the community exchanges are shown

by the smaller squares at the ends of the parallel radial lines, which indicate the public roads. The telephone pole lines are indicated by the dotted lines, as trunks, and the toll lines are shown by dot and dash; the shorter dotted lines, as in the cluster around one community exchange being the subscribers' short lines, the instrument station in each case being marked by the small solid black square. The cross-hatched lines simply represent railroads. It will also be seen that where there is one toll line running through the city and territory but two main leads of trunk lines would have to be run in order to cover the territory, the remaining lines being run on the poles that carry the toll lines. If happily there should be toll lines running through the territory to all four directions of the compass, there would be no additional expense for pole lines for the trunk lines to these various community exchanges.

This service has, it is stated, gone beyond the limit of theory, as there are several exchanges giving this service to country subscribers, and with profit to themselves and their increased list of patrons. At such points the farmers are given connection to their neighbors over the lines of their own individual exchange or to city subscribers or



FARMERS' COMMUNITY TELEPHONE EXCHANGE SYSTEM.

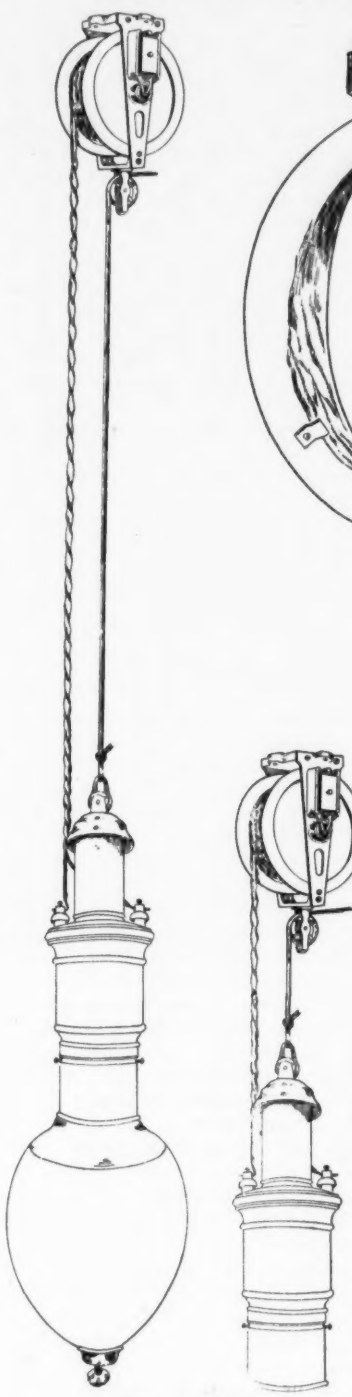
those of other community exchanges by trunking into these various exchanges. Exchanges that have introduced this service have also found they had a material increase in their toll line receipts as the patrons of the community exchanges can connect through the city exchange to all the toll lines to which the city exchange connects. Increased earnings and double the scope of the city service has thus resulted, and many an exchange that has formerly paid little if any dividends on its investment has, in this way, been put on a good paying basis. In some instances the farmers themselves are taking up this matter, organizing the community exchange service and arranging with the nearest city exchange for city connections and trunking to the various community exchanges that are connected therewith.

We also show herewith cut of the switchboard that is used at "Central" for the community exchanges. This combination board and telephone is absolutely simple, having no complex mechanism that could get out of order. All telephones that are furnished for the farmers' use are of the long distance type and equipped to give service over the longest toll lines.

Another recent feature of the work of the North Electric Company, on the more detailed side of their work, is their transformer type of repeating coil, to which reference was made in our last issue as being a desideratum in up-to-date work. It is shown in the accompanying cut. The coil is a double-spool, eight-division arrangement, with an absolutely closed magnetic circuit. In its construction the highest grade of soft Swedish iron is used, and the insulation of the pure copper wire used is also given the greatest attention. The coil is accurately balanced, and is perfectly moisture proof, and an increase of 20 per cent. in the efficiency is claimed for the device. Great success has already been won with this coil, and the demand is rapidly increasing.

The G-I Arc Lamp Hanger Reel.

This appliance illustrated in Figs. 1, 2 and 3 is being placed on the market as the only device of the kind fully covering all the requirements for a self-winding electric reel to feed an arc lamp or similar electric fixture which it is desired to raise and lower, for use and for trimming, without resort to long step ladders, etc. It is of very simple and substantial construction. The drum is of iron; the insulating parts are of slate and the current carrying parts, of course, of copper. It can be used indoors or out, and is fire and waterproof.



FIGS. 1 AND 2.

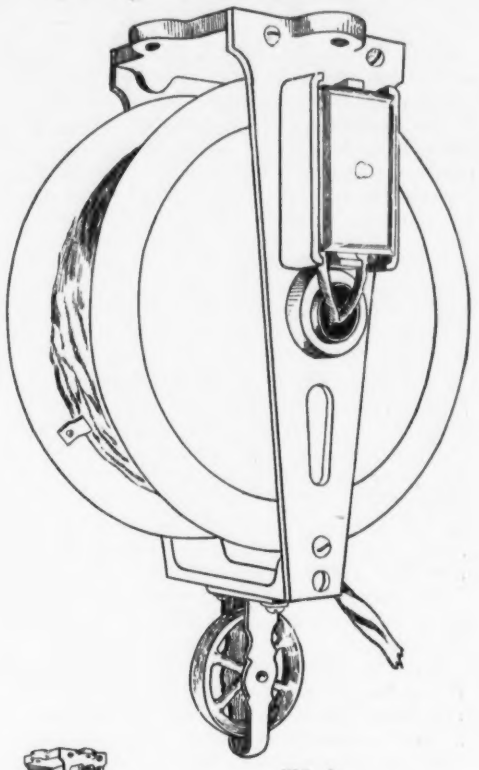
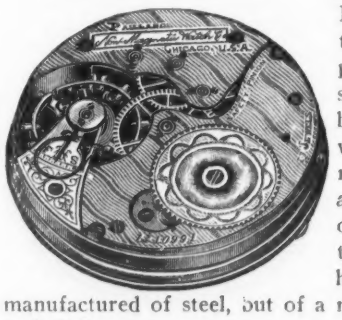


FIG. 3.

Our illustrations show the device in both positions (when raised and when let down) and hardly require further explanation, but we may add the following. The cast iron drum is supported with iron brackets, as shown, which can be fastened to a ceiling, a wall, a pole or any similar support. Inside of the drum is a strong tempered coil spring of the proper power to take up the flexible conductor carrying the current, which winds or unwinds on the outside of the drum. On the supporting brackets are mounted the porcelain cut-outs required by the Underwriters' Rules. This device is manufactured by the General Incandescent Arc Light Company to comply with these rules in all respects.

A Non-Magnetic Watch.

The accompanying cut illustrates a non-magnetic watch which is being placed on the market by A. C. Becken, and for which it is claimed that it will absolutely preserve its proper movement, no matter how strong a magnetic influence may be brought near it. The non-magnetic watch is undoubtedly an absolute necessity with electrical engineers and dynamo tenders, and in fact any one who is required to be near electrical apparatus. In this watch the hairspring and balance are not manufactured of steel, but of a material that is unaffected by magnetic influence.



NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—On the whole, last week was very much of a "hoodoo," but the general strength of the market was remarkable, despite the falling off in bank reserves, the troubles in the Transvaal and the Dreyfus agony in France. All things considered, stocks may be said to have gained, and the week closed with quite an advance in industrials. During the period, Western Union, on sales of 2401 shares, advanced ⅜ to 89⅛. General Electric was off 2 to 123 on small dealings in 850 shares. Brooklyn Rapid Transit, on sales of 177,740 shares, went off ⅛ to 104⅛ and Metropolitan Street Railway, on dealings in 21,600 shares, gained 4½ to 210½, and Manhattan Elevated gained 3⅝ to 117⅞. Twin City Rapid Transit preferred closed at 137. In Boston, American Bell Telephone closed at 360; Erie at 104½; New England, 155; Mexican, 6¼; West End, 95½; Massachusetts Electric Companies, 26. In Chicago, Metropolitan Elevated closed at 67, preferred; Lake Street Elevated, 18; Chicago Railway, 121½; West Chicago Consol. 5s, 106½. In Philadelphia, Electric Storage Battery Co. closed at 135-145 common, and 145-155 preferred. Electric Co. of America, 19¾; General Electric Automobile, 7; Penn Mfg. Co., 29½; National Electric Co., 12¼; Philadelphia Traction, 99¼; Union Traction, 41½. In New York outside securities, Electric Boat closed at 22-24 common and 44-47 preferred; Electric Vehicle, 102-107 common and 115-125 preferred; Electric Axle Lighting, 5¾-6¼; New York Elec. Veh. Trans., 22¾; New England Elec. Veh. Trans., 9¾; Illinois Elec. Veh. Trans., 5; General Electric Automobile, 17-24.

MANHATTAN AND METROPOLITAN.—Wall Street believes that a Manhattan-Metropolitan "deal" is under way, due to the general resort to electricity on both systems. Manhattan stock is not advancing on its present earnings or record of the last year, that is certain. The report in the street that the Metropolitan system is willing to take Manhattan and guarantee 5 or 6 per cent. on the stock is regarded as somewhat odd, in view of the fact that even with the possible benefits of consolidation Manhattan could not earn such dividends on its present large capitalization. Electricity may help it to do so, however. Metropolitan may eventually acquire the control of the elevated roads, but the chances are that it will not guarantee 5 or 6 per cent. on the stock, despite the fact that Mr. Sage says that if he sold his Manhattan holdings he could not find any investment half as good.

PHILADELPHIA CONSOLIDATION.—A big scheme now on the tapis and referred to in detail in our Philadelphia notes, is the consolidation of the Pennsylvania Manufacturing Company, which controls most of the local lighting in the Quaker City, and the National Electric Company, which owns a number of plants outside and elsewhere. The terms of the proposition for the taking over of the Pennsylvania Manufacturing and the National Electric by a new company include a provision for a cash dividend of $2.50 per share for Pennsylvania Manufacturing stockholders. This figure would represent a total cash distribution of $750,000 to Pennsylvania Manufacturing stockholders.

BELL TELEPHONE EARNINGS.—As to the average earnings under the American Bell Telephone system, one who should know is quoted as follows: "People make a mistake in thinking that the licensee companies of the American Bell Telephone Company are making such tremendous earnings through the charging of exorbitant rates. As a matter of fact the combined earnings of the Bell companies during the past year show but a trifle over 7 per cent. earned on their capital and less than 6 per cent. was divided."

WESTERN UNION DIVIDEND.—All reports in respect to a probable reduction in Western Union dividends were set at rest on Tuesday by the action of the Executive Committee of the company, which at a meeting recommended the payment of the regular dividend. This, accordingly, will be declared. The announcement of the decision had a favorable effect on the stock of the company, which notwithstanding the generally unfavorable conditions, rose to 89. The dividend was earned, and more.

CLEVELAND, OHIO.—A mortgage for $3,000,000, given by the Northern Ohio Traction Company to the Central Trust Company, of New York, trustee, has been filed. The mortgage is given to insure bonds that were issued as a result of the consolidation of the Akron Traction & Electric Company and the Akron, Bedford & Cleveland suburban road.

BOSTON ELEVATED.—In accordance with the provisions of the lease of the West End Street Railway Company to the Boston Elevated Railway Co., a dividend rental of $1.75 per share will be paid to stock of record Oct. 2.

COMMERCIAL CABLE COMPANY has declared the regular quarterly dividend of 1¾ per cent.

Commercial Intelligence.

THE WEEK IN TRADE.—Chill winds may blow through Wall Street, but they do not affect the conditions of trade and manufacture, nor the general activity of the country. Wall Street dislikes tight money, but it is evident that one of the reasons for a higher rate is the demand for it in legitimate and growing industrial activities. Electrical branches all report a brisk demand for the fall, and a great many electrical factories are already running night and day to fill current orders. In the iron and steel trades *Bradstreet's* notes that the only changes in the situation are in an upward direction as to prices. Complaints of behindhand supplies and scarcity of material are still made. Work has in many instances, notably in shipbuilding, been delayed by backward deliveries of steel. Tin is strong at 32⅛c. for spot, with 1255 tons decrease in all visible supply; lake copper is steady at 18½c., with heavy buying for electrical use, and lead is quiet at 4.60. All signs point to profitable conditions in railroad affairs. Reports from sixty-one companies for the full month of August point to aggregate gross earnings of $43,007,450, a gain of 15 per cent. over August a year ago. Specially good reports come from the Southern and granger roads, and the number of roads showing decreases is exceptionally small. In net earnings also the showing is a remarkably good one. The gross receipts of sixty-four leading systems for the month of July show an increase of 19 per cent., while the net receipts of the same companies show a gain of nearly 25 per cent. Bank clearings reflect one holiday in a reduced total as compared with last week, and the aggregate for the week is $1,370,706,861, a decrease of 5 per cent. from last week, but a gain of 24 per cent. over the same weeks of 1898 and 1897 and of 61 per cent. over 1894, while as compared with 1892 there is a gain shown of 22 per cent. Business failures for the week number only 123, against 131 last week, 142 in this week a year ago, 173 in 1897, 308 in 1896 and 213 in 1895.

EXPORTS OF ELECTRICAL MATERIAL FROM NEW YORK.—The following exports of electrical material are from the port of New York for the week ending Sept. 9: Antwerp—45 packages electrical material, $3632. Athens—18 packages electrical material, $307. Argentine Republic—4 cases electrical material, $250. British Possessions in Africa—11 packages electrical material, $1145. British East Indies—22 cases electrical material, $1200. British West Indies—17 packages electrical material, $544. British Australia—160 packages electrical machinery, $22,000. Brazil—11 packages electrical material, $1441; 7 cases electrical machinery, $400. Bremerhaven—1 case electrical machinery, $31. Berlin—1 case electrical material, $11. Cuba—39 cases electrical material, $2181; 7 cases electric light material, $398. Constantinople—3 packages electrical material, $51. Central America—47 packages electrical material, $384. Copenhagen—5 cases electrical material, $250. Glasgow—4 packages electrical material, $770. Havre—10 cases electrical machinery, $517; 44 packages electrical material, $3092. Hamburg—2 cases electrical material, $25. Liverpool—49 packages electrical material, $3447. London—69 cases electrical material, $4752; 7 cases electrical machinery, $388; 9 cases electrical motors, $450; 16 packages electrical motors, $500. Mexico—21 packages electrical material, $393. Newcastle—1 package electrical material, $60. Newfoundland—2 cases electrical material, $32. Peru—3 packages electrical material, $18. Southampton—3 cases electrical material, $148; 26 cases electrical machinery, $280. St. Petersburg—5 cases electrical machinery, $278. Uruguay—7 cases electrical material, $242.

GLASGOW TROLLEY ENGINE CONTRACT.—The tremendous agitation which was aroused by the acceptance of the tender of an American firm for the supply of the engines for the Glasgow tramways had the immediate effect of causing the Glasgow Town Council to remit the matter back to the officials, and giving Mr. Parshall an opportunity of preparing a new specification. This specification was to be so detailed that all tenderers will be on the same basis. That is all that was desired, and given that uniformity the contract would go to the best firm, irrespective of nationality. This was the contention of our journalistic colleagues in England and of English building concerns. London *Industries and Iron* said in its issue of Aug. 25: "We feel the matter deserves the greatest publicity until settled in a way that can be regarded as fair and reasonable by English and Scottish engineers. The dimensions and weights should certainly have been made binding on all entering for the contract, for it is well known that the difference between standard practice here and in America is considerable. To have given the latter referred to by Messrs. Hick, Hargreaves & Co., and then reject the tender of Messrs. Stewart & Co., Limited, because of the lightness of the engines they designed, does not seem worthy

of the prestige occupied by Glasgow in the development of electric tramway traction. Anyhow, it is to be hoped the new move taken by the City Council will result in equality of opportunity for all concerned." The finale or answer to this is found in a despatch from London of Sept. 9, which says: "The Glasgow Town Council, in the face of considerable opposition, has confirmed the recommendation of the Tramways Committee giving the contract for two electric traction engines to the Allis Company. The order, it is said, has gone to America simply on account of the speedier delivery, and the decision of the Council has occasioned much disappointment to home firms. Two or three schemes for new electric subways joining London and its suburbs have just been successfully financed, and will be started in the autumn, and they are likely to supply further orders for American machinery." As in the case of the Atbara bridge, not only quality, but prompt delivery has counted.

ELECTRICAL DEMAND FOR MICA.—We are often in receipt of inquiries as to the value for electrical purposes of some new deposit or other of mica. There is no doubt that the mineral is in good demand, and the last official figures for 1898 show that the quantity mined was 129,520 pounds, worth $103,534. There were also 3999 tons of scrap mica, valued at $27,564. As to the general outlook, our contemporary, the *Engineering and Mining Journal*, sums it up very well by saying: "Among the minor mineral products which have been attracting attention recently, mica seems to hold a prominent place. This is largely due to the increased demand, due to its use as an insulating material for electric work. We are in receipt of inquiries from all parts of the country as to the uses and value of mica; and these show that prospectors are on the lookout for the mineral and have large ideas of its value. There certainly is a demand for mica which is in excess of the home production, as is shown by the considerable quantities imported, and a market could be found for an increased output. It is a mineral which can be found in many places, but unfortunately the deposits of commercial value are very few. The quality regulates the price entirely, and mica which comes up to the requirements of freedom from flaws, evenness of structure and, above all, size of sheets or blocks, is comparatively rare. Prospectors should bear this in mind and not be carried away by indications, which are apt to be very deceptive. It is also to be remembered that in mica mining there is always a very large proportion of dead work and waste material, so that only high grade deposits can be made to pay."

SOME MICHIGAN CONTRACTS.—President J. E. Lockwood, of the Michigan Electric Company, Detroit, informs us that they have received an order from the G. P. Magann Air-Brake Company for one 5-hp, 600-volt Western Electric semi-enclosed motor with back gearing, which the said company are to use in operating an air compressor they are to furnish the Detroit, Rochester, Romeo & Lake Orion Railway. They have also sold one 10-hp Western Electric 600-volt semi-enclosed motor to Charles Stinchfield, of Pontiac, Mich., to be operated from the railway circuit on voltage varying from 400 to 750, and will be used for driving a pump. They have been awarded the contract for furnishing and installing for John A. van der Poel, of Brookline, Mass., a complete electric plant for a yacht now building in Detroit, which will include a gasoline engine, Western Electric generator, switchboard, electric searchlight, storage battery and complete wiring, fixtures, etc., as well as electric revolution indicator and engineers' signal system, making altogether one of the most complete possible electric plants for a yacht. Since receiving the large order previously mentioned for over 21,000 Atkinson protected rail bonds from the Toledo, Fremont & Norwalk Railway, the company have received an order from the Detroit, Rochester, Romeo & Lake Orion Railway for 4300 foot bonds of the same make, and from the Detroit, Lake Shore & Mount Clemens Railway for 1000 Type E protected rail bonds.

AMERICAN MANUFACTURED EXPORTS.—That the growing popularity of American manufactures in all parts of the world is recognized by the manufacturing and mercantile communities of other nations is shown by a series of statements just published in the *Monthly Summary of Commerce and Finance*, issued by the Treasury Bureau of Statistics. While the general growth of export trade has been phenomenal, the feature which has naturally attracted most attention is the growth in exportation of manufactures and their popularity in markets formerly held by other nations. The exports of manufactures from the United States are now averaging a million dollars a day. In the 212 days, from Jan. 1 to July 31, the exports of manufactures were $211,975,904, or practically $1,000,000 a day, while in the corresponding period of 1895 the exports of manufactures were $110,389,940, or practically a half million dollars a day. The Bureau in issuing these figures quotes a number of significant and interesting comments on the general subject from technical and trade journals in England.

ALUMINUM AND COPPER.—We understand that the Standard Company, of California, which we mentioned last week as having placed an order with the Sprague Company for 25,000-hp of Stanley apparatus, has given an order to the Pittsburg Reduction Company for 1,000,000 pounds of aluminum wire. The specifications have not been made public. The Standard Company has a lot of aluminum wire up now, and would appear to be pleased with it. Aluminum cuts quite a figure with copper at present rates, as shown also by the recent order of the Hartford Electric Light Company for 33 miles of aluminum cable. The company is building a dam at Tariffville, Conn., 11 miles from Hartford, and will get 2300-hp for two 1000-hp generators, giving 10,000 volts. This is to be transmitted to the power station in Hartford. There will be three cables for transmitting. The wires will be bare and will run to within a mile of the city limits, when the current will be stepped down to 2400 volts. The cable is about one inch in diameter, and has a conductivity equal to No. 0000 copper wire. Aluminum is to be used in the high pressure transmission line only, and by its use the company expects to save $3500.

ELECTRIC AUTOMOBILE BUILDING is very brisk this fall and is making demands for an immense quantity of material. The Electric Vehicle Company is steadily receiving new cabs and vehicles from the shops of its manufacturing companies under the order for 4200 vehicles placed some time since. The works of the Columbia & Electric Vehicle Company at Hartford, as well as the factory of the New Haven Carriage Company at New Haven, owned by the Columbia, are working night and day on the order. The motors for these vehicles are being built at the Siemens & Halske Works in Chicago, also owned by the Electric Vehicle Company, and are being turned out in sufficient numbers to meet the present requirements. About 200 more vehicles will be ready, it is said, before the 1st of the month. These will be distributed in New York, Boston and Chicago. Mr. J. M. Hill has his hands full arranging the distribution of the automobiles as they are turned out.

LOWER COPPER EXPECTED.—As regards the price of copper, a Calumet & Hecla official is quoted as follows: "I believe 18½ cents is the maximum price. We have 10,000 tons which we can sell at that figure for delivery between now and Jan. 1, 1900. I look to see copper sell at 16c. for May delivery, 14c. by Jan. 1, 1901, and possibly 9c. in four years. Any man who figures above 11¼c. for copper in my judgment makes a mistake. Until the recent rise in copper we found our average price received for nine years was just 11¼c., and we have been in a position to obtain the best figures possible. The present high figures are adverse to the copper industry in this country. I understand that a prominent metal broker has come from Europe less optimistic regarding the copper situation and that he has been offering copper under 18½c. If it were possible to secure a satisfactory guarantee, we would gladly sell our production for the next five years for 12c. per pound."

BRIDGE BUILDERS' CONSOLIDATION.—There is so much interrelation to-day in many ways between the electrical arts and those of bridge building we are all very much interested as a matter of course in the news that the first steps in the consolidation of 90 per cent. of the bridge building concerns of the United States have been taken, and that it is now practically certain that a gigantic combination of capital known as the American Bridge Company will soon be consummated. The representatives of the thirty companies that have formed the combine concluded their work at the Waldorf-Astoria last week. The new company will be financed by J. & W. Seligman & Co., of No. 21 Broad street. The capital will be in the neighborhood of $65,000,000, of which $30,000,000 will be preferred stock and $35,000,000 common stock.

BIGGER GAS ENGINES.—It is very interesting to note the manner in which gas engines are gaining in size, so that to-day they often run into powers which ten years ago would have seemed large for steam. Westinghouse, Church, Kerr & Co., who are protagonists for this type, have closed a contract with the Iola Portland Cement Company of Iola, Kan., for twelve Westinghouse gas engines, aggregating 3000-hp. Nine of the gas engines will be 300-hp. each, one 125, one 50, and one 10. The purchasers will use natural gas for fuel, the supply being obtained from a well on the company's premises. Gas engines of 650-hp are becoming numerous. The Westinghouse Machine Company is placing one of this size in the Carnegie Steel Company's works, Pittsburg, and one in the power house of the Columbus, O., Electric Company.

SPECIFICATIONS FOR POUGHKEEPSIE, N. Y.—The Poughkeepsie Electric Light & Power Company have experienced a large growth in their business and have decided to install additional capacity as represented by a 750-hp compound condensing engine, the electrical output to be devoted entirely to new work, in addition to the present capacity. Mr. W. R. Maloney is the secretary of the company, and will furnish specifications upon request from responsible parties.

PORTSMOUTH, N. H., NAVY YARD.—The new electric light and power building at the yard will be 120 feet square; that is, with the pumping house for the new dry dock. The bids for the two boilers for the electric light plant have been received from Washington. The lowest bidder was the Aultman & Taylor Co., of New York, at $9200.

Special Correspondence.

NEW YORK NOTES.

New York, Sept. 11, 1899.

LIGHTING PROSPECT PARK PLAZA.—Deputy Commissioner Walton, of the Department of Public Buildings, Lighting and Supplies, has decided on the improvement of the lighting of Prospect Park plaza, Brooklyn. He has ordered the lighting of the eight large electric lamps around the memorial arch, which will be used every night.

POWER HOUSE ON THE MEADOWS.—The Brooklyn Rapid Transit Company has just bought 25 acres of land on the meadow between Flushing and Corona. The company will erect on this property a system of barns for storing cars and a power house. The meadow land is being filled in and work will be commenced shortly. The building will be of brick, with brownstone trimmings and slate roof.

ROSSITER-MACGOVERN COMPANY have been incorporated under the laws of New Jersey, with a capital stock of $250,000, and headquarters at 35 New Railroad Avenue, Newark. The stated objects of the concern, whose principals are well known in the electrical field, are to build power houses, construct electric railways, etc. The incorporators are Frank Macgovern, Van Wyck Rossiter and Isaac M. Sutton, all of Newark.

MR. A. B. FINK, secretary and manager of the Diamond Meter Company, of Peoria, Ill., was in New York last week purchasing supplies and looking up the numerous friends of that company. He reports that for the first time in their history they have run full time all through the summer months. The prospects for fall and winter business are that they will break all previous records on the output of the Scheefer wattmeter.

ELECTRICITY TO BE TRIED.—If an experiment shortly to be tried by the Standard Oil Company in its Queens County plant proves successful, the motive power in the company's plants is likely to be changed from steam to electricity. Henry C. Folger, Jr., local manager, said a few days ago: "We are going to try electricity in the Queens County Oil Works on Newtown Creek for driving our pumps and machinery. The substitution is made for economic reasons. The experiment will cost about $30,000."

NEW BUILDING CODE.—The new building code of the city of New York, as prepared by the Building Code Commissioners, is the most extensive and comprehensive system of laws that has been drafted for any municipality in this country. The commissioners say that they have attempted to cover the entire ground so that no matter need be left in doubt in the minds of contractors, builders, or persons desiring to erect buildings in the city and to render them safe according to modern ideas in civil, mechanical and electrical engineering.

THE MANHATTAN GENERAL CONSTRUCTION COMPANY report that their New D. C. Manhattan lamps are giving the best of service, and that their agents predict a large business this fall. The Manhattan Company have just shipped 87 of these lamps to W. H. Elsinger & Co., St. Paul, Minn., owners of the Golden Rule Dry Goods store, and have been awarded the contract for 142 lamps for the dry goods store of B. Nugent & Bro., St. Louis, Mo., they being the highest of nine bidders. Among other orders mentioned was one of 60 lamps, secured through their Chicago agents, Messrs. William Sharpe & Son, for the American Bridge Works, of Chicago.

DISHONEST BROOKLYN CONDUCTORS.—As a result of a report by "spotters" employed by the company and an investigation of accounts, the Brooklyn Rapid Transit Company has lately discharged some 200 conductors for "knocking down" fares, and it is claimed that since the strike there has been a wholesale stealing going on which has reduced the revenue of the company by $50,000. Detectives have been at work, and it is claimed that many of the conductors had adopted the system of taking half the fares without registering them, while others not of such a liberal turn of mind have appropriated as high as 60 and 75 per cent. of the fares turned over to them. An official of the road said last week that all records in this line had been broken by the conductors, and as fast as the dishonest ones were discovered they were discharged.

MANHATTAN TUNNEL COMPANY.—The Joint Committee on Railroads of the Municipal Assembly gave a hearing last week on the application for a franchise of the Manhattan Tunnel Company. The route of the tunnel is as follows: Beginning at a point in Chambers Street 100 feet easterly from the easterly line of West Broadway, and thence running westerly and underneath Chambers Street, West Broadway, Greenwich, Washington and West Streets to the shore line of the Hudson River, and thence through a tunnel underneath the Hudson River to the limits of the ownership and jurisdiction by the City of New York. David J. Newland, the president of the company, stated that the application was for a 50-year franchise, that the rate of fare would be 3 cents a mile, that the tunnel would be 6000 feet long, and that it would be completed in 20 months. The company, he said, had ample capital. No one appeared in opposition to the plan, and the committee took no action.

THE TROLLEY IN PELHAM.—The people of this village are urging Highway Commissioner Michael J. Donlon to revoke the franchise granted to the New York, Westchester & Connecticut Traction Company. This franchise was granted last February, and, although for only a mile, is for the only convenient connection the company will be able to make between its proposed lines in the annexed district of New York and Mount Vernon and New Rochelle. It was secured by the traction company after a hard fight with its old rival, the Union Railroad, and the successful company was to begin building within six months and have the road in operation within a year. Commissioner Donlon admitted that, although the time is almost up, not a shoveful of earth has been turned on the road, and there are no indications that it will ever be built. He says that unless the company complies with its contract he will take steps to declare the franchise invalid, and give it to some company that will build.

DEMURRER IN CONDUIT SUIT.—Root, Howard, Winthrop & Stimson, counsel for the Metropolitan Street Railway Company, have filed a demurrer to the complaint in the suit of William H. Rieger, brought as a taxpayer, to restrain the company from using the conduits it has laid along its lines for any other purposes than the operation of its traction system in accordance with its charter. In the action James P. Keating, Commissioner of Highways; Henry S. Kearny, Commissioner of Public Buildings, Lighting and Supplies, and the city of New York are joined with the railway company as defendants. The demurrer is very brief, simply alleging that the complaint does not state facts sufficient to constitute a cause of action. Mr. Elkus, counsel for the plaintiff, said that the case would not again come up in court until the first Monday in October. The defendant company could still file an answer or could go to argument on the demurrer. If beaten on the latter, it could secure an extension of time in which to answer.

RESTRICTING TRANSFER SYSTEM.—Persistent efforts on the part of unscrupulous men and women to take undue advantage of the transfer system on the Metropolitan Street Railway lines in this city have led to the recent enforcement of more rigid rules regarding transfer privileges. The rules of the Metropolitan Company provide for a system of transfers which will enable a person to travel from any point up town, on either side of the city, to any point down town, and vice versa. This liberal policy, it is alleged, has been grossly abused. In order that the legitimate purpose of the transfer system may be carried out, with a minimum of cheating on the part of passengers, orders have been issued to the Metropolitan conductors to give only one transfer to a passenger hereafter, with the exception that on the crosstown lines in Eighty-sixth Street, Fifty-ninth Street and Thirty-fourth Street, a transfer will be given on a transfer so that a person going up or down town may transfer on a single fare from one side of the city to the other.

AUTOMOBILE-HANSOM RACE.—Patrolman Frank L. Baxter was standing near Thirty-second Street on Broadway about 4:30 o'clock one morning last week when his attention was called to the loud clatter of horses' hoofs coming up Broadway. He saw that a horse attached to a hansom cab was being driven at a break-neck speed. As the cab neared him the shrill voice of a woman was heard crying for help. Baxter, who was standing near an electric automobile, jumped on the seat next to the driver and gave chase. The automobile shot ahead, and the spectacle of the fleeing cab and the pursuing automobile speedily drew a crowd. The hansom turned the corner of Forty-sixth Street, with the automobile almost touching it. Patrolman Baxter jumped off the automobile and arrested a young man and woman as they alighted from the cab. In the Jefferson Market Police Court, where the couple were arraigned, they were both fined $5 for disturbing the peace, and decided not to try odds again with an "auto." The ease with which the electric overhauled the horses caused great surprise.

AUTOMOBILE HACKS.—When the electric automobiles in this city first started in the hack business the price was fixed at 30 cents an hour. The men have to take out a city license, and number their cabs the same as the public hackmen, but they are not union men. Because the automobiles were cheap many persons rode in them for the novelty of the thing. At present the automobile company has only one stable and about 80 electric vehicles in service. Nearly all of these are in constant demand, for call orders keep these cabs busy, and the number available for hacking is constantly diminishing. The automobile charges are about the same as the livery stables. To the theatre and return costs $2.50, with the usual $1 allowance if you wish to stop an hour for supper. After one o'clock in the morning the price is $1 an hour more. It costs $3 to go up to Riverside drive. "Steady riding," as it is called, is charged by distance—50 cents a mile. One of the officers of the company says: "The time is not very far off when there will be 2000 electric public cabs in the streets of New York, and an average cab fare of 25 cents a mile, day and night, with plenty of cabs to make the service a success. The automobile cab has caught on in New York, and public hackmen are tumbling over one another to get jobs where they can learn how to work them."

NEW ENGLAND NOTES.

Boston, Sept. 11, 1899.

THE MUNDER ELECTRICAL WORKS, of Springfield, Mass., will furnish about 15,000 incandescent lamps for the Dewey welcome sign on the Brooklyn Bridge and other decorations connected with the Dewey festival.

PORTLAND, ME.—The Metropolitan Electric Third Rail & Traction Company has been formed to push a third rail system of propelling electric cars. Capital, $500,000. Incorporators, G. S. Merrill, G. M. Cleveland, of Boston; G. W. Hills, of Newton; C. W. Woodward, J. R. Harrison, of Watertown; C. E. Clark, J. B. Parsons, of Cambridge, Mass.

THE AMERICAN BELL TELEPHONE COMPANY will soon cover its property, Nos. 115-119 Mill Street, with an addition to its building on the corner of that street and Oliver Street. The new structure will be about 50 feet front and cover nearly 7000 square feet. The plans, by Peabody & Stearns, call for a building, in general terms, similar to that on the corner. The lots were purchased some time ago, and now have old four-story brick buildings upon them. The telephone companies will probably occupy all of the new building. The Bell Company will also make an improvement in its Oliver street parcel in the rear of the corner building, but not on so extensive a scale as on Milk Street.

NEW HAVEN, CONN.—With the purchase of the Kickapoo Indian Medicine Company's plant in this city by Pettingill & Co., of Boston, for a third party unnamed, this city will have two automobile factories, each to be conducted on the most advanced plan, and to turn out annually thousands of new motor carriages. Some months ago the Electric Vehicle Company bought the manufacturing property of the New Haven Carriage Company, and work will begin soon on an order of 1000 motor wagons for this plant. The new company will also begin the manufacture of nearly as many vehicles, the first of which are to be on the market by next spring, the bodies only to be made here. The purchase by Pettingill & Co. is for $30,000, assuming also a mortgage of $15,000 on the property.

PHILADELPHIA NOTES.

Philadelphia, Sept. 11, 1899.

MR. HARRIS COMER, successor to Wood & Comer, manufacturers of chemical apparatus and general scientific supplies, of 130 South Clifton Street, has removed to 622 Locust Street.

ALLENTOWN, PA.—One of the Traction Company's barns and some of their shops have been destroyed by fire. Eight cars and all the machinery in the buildings were destroyed. The loss will amount to $25,000, which is fully covered by insurance.

PARTRICK, CARTER & WILKINS, of Philadelphia, the well-known manufacturers of annunciators and bells, as well as of all electrical house goods, are arranging to have a very complete exhibit of all articles manufactured by their company at the Philadelphia National Export Exposition. Their exhibit promises to be one of the most interesting features at the exposition.

MR. LEVI TEAL, of the S. S. White Dental Manufacturing Company, Philadelphia, has just returned from a very delightful fishing and yachting trip, together with several other Philadelphia gentlemen. Mr. Teal reports having had a most enjoyable time and having been very successful in catching fish. He has returned very much benefited in health and spirits, and full of really truthful fish stories.

NEW KENSINGTON, PA.—Rights of way have been granted for an electric car line at New Kensington. The road is to be about seven miles long, and will touch Parnassus, Arnold, Creighton and Springdale. A promise has been made to the borough council that the line will be completed within a couple of months. It is said that it is the purpose to extend the line to Pittsburg finally.

MERCHANTVILLE, PA.—The subject of extending the trolley road to Pensauken is still the topic of conversation, and the general committee of 15 citizens are endeavoring to have the company commence work as soon as possible. The committee met last week, and after considerable discussion as to the route appointed a committee to meet with the officials of the trolley road and, if possible, decide on a route.

WILLIAMSPORT, PA.—A committee of councils has awarded the contract for lighting the streets of Williamsport with electricity to Thomas Lynch, of Philadelphia, at $50 per light per year. This is $30 per lamp cheaper than Williamsport is paying at present. Mr. Lynch wanted to withdraw his bid, but as the committee had his certified check for $1000, and as his bid is about $18 per lamp lower than the next lowest bid, the committee would not allow the withdrawal.

PLAINFIELD, N. J.—The last link in the trolley line between Elizabeth and Plainfield finally has been granted by the action of the Roselle Borough Council in passing the ordinance giving the Elizabeth & Westfield Street Railway Company, known as the Riker syndicate, a franchise through that town to the Elizabeth city limts. There connections will be made with the North Jersey Traction Company, bringing together about 200 miles of electric street railways. The company is under $20,000 bonds to complete the road by April 1, 1900.

THE MAJESTIC HOTEL, to be built on North Broad, Stiles and Watt Streets and Girard Avenue, will be one of the finest edifices in this city. The ground was bought from Mr. W. L. Elkins and H. E. Cregier & Co., of Boston and Chicago, are the architects. The total cost will be $1,750,000. There will be 600 rooms and in a curious way the Elkins mansion is to be built around and incorporated into the general plan. The electric light and power plant is to be very fine, and there will be electric elevators, a complete telephone system, a $35,000 cathedral organ pumped electrically and other notable features.

FURTHER LIGHTING CONSOLIDATION.—The consolidation of nearly all the electric light companies in Philadelphia is an assured fact. At the present time most of the companies of the city are controlled by the Pennsylvania Manufacturing, Light & Power Company. There are but four other companies, and three of these are in the hands of the National Electric Company. This leaves one independent concern, the Kensington Electric Light Company. The heads of the Pennsylvania Manufacturing, Light & Power Company and the National Electric Company met recently and considered plans whereby the two concerns might work so as to monopolize the business in this city. William F. Harrity, president of the National Electric Company, says: "The deal has been virtually completed. It has not been absolutely closed, but its successful termination is a certainty." It is intended to establish a new company, with a capital of $10,000,000. This new company is to absorb the Pennsylvania Company and the National Electric Company. Just who the president of the new concern will be is a matter of conjecture, but it is rumored that William J. Latta is the man.

MR. HENRY B. CUTTER, president of the Cutter Company, of Philadelphia, who recently recovered from the shock occasioned by the steamer crashing into an iceberg of considerable size, was able to express himself as delighted with the results and benefits of his prolonged European trip. While away, Mr. Cutter visited England and Scotland, France, Switzerland, Germany, Holland and Belgium. He inspected most of the important electrical establishments, and reports himself as being somewhat surprised at the magnitude of the electrical industry, in Germany particularly, and also at the comparative neglect which switchboards have received up to a very recent period. Now that the foreigners are beginning to pay attention to this important feature of electrical installation, great and rapid improvements are to be looked for. As to the further introduction of American apparatus, he states that there is a spirit of patriotism to be overcome, rather than any inherent objection to our product. He found some interesting imitations of the I-T-E circuit breaker (not entirely unknown in this country), with all the good points left out, selling at considerably higher prices in Germany than rules for the genuine article here. As the I-T-E circuit breaker has been made to feel thoroughly at home in Europe, it was rather to look over the field than to begin operations that took Mr. Cutter abroad.

CANADIAN NOTES.

Ottawa, Ont., Sept. 9, 1899.

HAMILTON, ONT.—Now that the city of Hamilton, Ont., has secured cheap electric power from near the Welland Canal, electricity is rapidly displacing steam in many of the industries of that city and vicinity, as well as being used to operate the street railway, electric lighting plant and several radial railways that run out of the city. The latest proposal is to use electricity to operate the machinery at the sewage interception works.

PROF. L. A. HERDT, lecturer in electricity at McGill University, Montreal, has written a letter to the Board of Trade of that city, on the subject of lighting the channel of the St. Lawrence River, with a view to carrying on navigation at night. He proposes to place a projector or searchlight on the bow of every ship. This would cast light upon a double row of white buoys defining the channel. The matter was referred to the harbor engineer for report.

CONDUITS FOR OTTAWA.—The city engineer of Ottawa has prepared a report in regard to the construction of conduits for the accommodation of the telegraph and telephone lines of the city. His idea is to build a brick conduit large enough to accommodate the gas and water mains, as well as the wires. From a surface of concrete, which is to be six inches in thickness, the height of the conduit to the crown of the arch will be four feet six inches. The width from side to side will be four feet. With straight walls, the top will be semicircular in shape, built of brick to a thickness of nine inches. He considers that in cities overhead wiring is objectionable from every standpoint.

POWER CANAL AT BRITANNIA.—Trouble is brewing between the promoters of the Metropolitan Electrical Company, of Ottawa, and the contractors who have the construction of their works at Britannia in charge, unless greater expedition is made in the completion of their contract. The limit set is the end of December, but at the present rate the desire of the promoters will not be realized. The engineer demands that 300 more men be at once employed. The crib-work all round the power canal, which is being cut through the solid rock, will be held in position primarily by immense iron bolts run deep into the rock. About 3,000,000 feet of timber will be utilized in making the crib-work, which at the lower end will be 20 feet high.

LARGE STREET RAILWAY DEAL.—The deal by which the Cataract Power Company syndicate comes into possession of the Hamilton Electric Street Railway, the Radial Electric Railway and the Hamilton & Dundas Railway has been concluded, the business of the street railway passing into the hands of the syndicate on payment of about $130,000 for the controlling interest in the stock. It is understood there will not be any radical changes in the management of the railways for a while. The syndicate will shortly proceed to build electric railways to Galt, Guelph and Brantford, these being now projected. Hon. J. M. Gibson was elected president of the syndicate, Mr. John Dickenson, M. P. P., vice-president, and J. B. Griffith, secretary-treasurer.

RADIAL RAILWAY SYSTEMS.—The value of radial electrical railways has been amply demonstrated wherever they have been built in Canada. They act as feeders to business centres, but from the standpoint of the radial company the chief difficulty is in securing sufficient winter traffic at first to pay expenses. In some rather unpromising routes along which these car lines have been built the investors have been surprised at the amount of traffic which has been secured at that season, though the original estimates had been based on the summer patronage. Ottawa will have its first radial road under construction this fall, the Ottawa Electric Company now being engaged in letting contracts for the construction of a line to Britannia. According to the plans filed, this line will not follow the traveled road most of the way, but will take a direct route across country, thus facilitating a fast service.

CINCINNATI NOTES.

Cincinnati, Ohio, Sept. 9, 1899.

MR. BOLLES, of the Bullock Electric Company, has been on the sick list for some time past, but is recuperating now.

WAYNESVILLE, OHIO, is figuring on an electric plant and has called upon Cincinnati experts to estimate the cost.

THE JANTZ & LEIST ELECTRIC COMPANY have moved their uptown headquarters from East Ninth Street to 808 and 810 Elm Street.

PRESIDENT T. J. CREAGHEAD, of the Creaghead Engineering Company, has returned from a trip to New York, Boston and Philadelphia. He reports business booming. The Creaghead Company is just commencing a contract for the electric supplies for the Dayton, Xenia & Bellbrook Electric Railway Company. The road is to be 25 miles in length, and Mr. Creaghead expects to have the electric supply part of the contract filled in six or eight weeks, if other contracts are executed promptly.

MANAGER WM. A. McCALLUM, of the Electric Railway Equipment Company, reports enough orders ahead to keep them busy until Christmas. A large contract just received, aggregating something like $20,000, is for overhead line material for the Milwaukee Electric Railway & Light Company. Their foreign business is steadily growing. The two factories are both running overtime. The Reading plant has been running on double time since the first of the year. This factory is getting out some large orders for street railway work in South American countries and Cuba. One big order is for side and strain poles for Mexico and Cuba, to be shipped from New York. "We are two or three thousand poles behind in our orders at the present time," said Mr. McCallum, "and are thinking of building a new factory in Cincinnati. We shall do it immediately if we get a place to suit us." President Charles Andrew, of the company, is now in New York City, on a business trip. He will remain a week or so.

CHICAGO NOTES.

Chicago, Sept. 9, 1899.

ERIE TELEPHONE.—The Central Union, Pacific Coast and Erie Telephone systems made a net gain of 7755 subscribers in August.

MR. THOMAS R. MERCEIN, secretary of the Northwestern Electrical Association, with headquarters at Milwaukee, is on a business trip to Chicago this week.

MR. JAMES C. WORMLEY, the popular representative of the Shelby Electric Company, of Shelby, Ohio, has been spending a few days in Chicago in the interests of his company.

MR. H. L. PARKER, president and general manager of the Emerson Electric Manufacturing Company, with headquarters at St. Louis, Mo., was a welcome visitor in Chicago last week.

QUINCY, ILL.—The Quincy Light & Power Company and the Empire Light & Power Company have filed a certificate of consolidation under the name of the Quincy Gas & Electric Company. The capital stock of the consolidated company is given as $600,000.

TWO-CENT STREET RAILWAY FARES.—The Chicago General Electric Railway has begun the sale of 12 tickets for 25 cents on its branch lines, each branch line being a little over two miles in length. The ticket gives a rate of a cent a mile, but does not entitle the purchaser to a transfer to the main line.

PULLMAN, ILL.—The Calumet Electric Street Railway Company has secured a right of way from the Pullman works through Pullman, paralleling the Illinois Central Railroad tracks from 104th to 115th Street, Kensington. Work on the road will immediately commence. By this arrangement the street railway company will have a competing suburban line for the entire distance from Sixty-third Street to Kensington.

TROLLEY PARTIES.—Trolley parties in the air will become popular in Chicago if the elevated railway companies can make them so. The South Side and "Polly L" street car railroads have entered into an agreement whereby after Sept. 15 excursion trains of one company may run over the tracks of the other. By this arrangement rides of from 14 to 20 miles can be given within the city, and the corporations propose to fit up luxurious cars for the accommodation of pleasure-seekers, if the plan proves popular. The first excursion will be given Sept. 16 under the auspices of the employees of the "Polly L."

WATER PURIFICATION is pretty badly needed in this town, and the passing of electrical currents through long columns of lake water to filter it and render it absolutely pure for drinking is the pith of an experiment to be made at Evanston. A newly invented electrical device which, it is claimed, will precipitate any foreign matter in the water and destroy all microbes is to be put in place at the water works for a trial. Louis Gathman, inventor of the Gathman gun, has worked out this new system of water purification. It is said that the water is clarified by an electrical current of high voltage. Those of us who drink water will report progress.

ENGLEWOOD SMOKE.—The fight of the citizens of Englewood against the Commonwealth Electric Company, which is charged with maintaining a smoke nuisance, is going on. According to Attorney H. M. Coburn, who has conducted the fight for the complainants, the company is to be assailed in the courts on another ground in addition to the charge that it pollutes the neighborhood with smoke and noxious gases. Mr. Coburn has a petition signed by 75 residents of the neighborhood setting forth that the company is using 33 feet of Wallace Street without authority and has fenced in land which for 30 years prior to 1895 was the property of the public and was used as a street.

ILLINOIS ELECTRIC VEHICLE.—Within a short time the Illinois Electric Vehicle Transportation Company, with offices at 1215 Monadnock Building, will have a dozen automobiles in active operation on the streets of Chicago. Negotiations are now pending for a satisfactory site for a central charging station, and as soon as that is decided on the machines will be placed on the streets for the use of the public. The company has five motor cars here now and W. L. Githens, general superintendent of the company, says four more will arrive this week. They are intended to enter into active competition with the conventional carriages and cabs, and the tariff will be a trifle cheaper than livery charges. The charge for the present will be according to the distance traveled, and not by the hour.

A LONG ROAD TO JOLIET.—Mr. F. E. Fisher, superintendent of the Joliet Street Railway Company, has announced that what is known as the Chicago & Joliet Rapid Transit Company will at the next meeting of the Will County Board of Supervisors petition for the right to construct, maintain and operate an electric car line from the present northern terminus of the Joliet line in Lockport through the townships of Lockport and Du Page, along the Romeo road to the Cook County line. This is believed to be the first practical step toward the construction of the long-promised electric line between Joliet and Chicago. The intention of the Joliet Company is to connect at Lemont with the proposed line of the Chicago & Desplaines Valley trolley road for which a franchise was granted a year ago. E. A. Cummings is one of the principal movers in the Chicago enterprise.

MR. GEORGE E. FISHER, president and treasurer of the Chase Construction Company, Detroit, Mich., general contractors, has secured the contract for his company for constructing the Toledo, Fremont & Norwalk Railway, from Toledo to Fremont, Ohio, which includes all work outside of the power house and bridges. The company will employ a force of 200 or more men on this contract, when the work is fairly under way, preliminary work having been started last week. Mr. Fisher states his company have had a very busy season and are now completing the large municipal electric lighting plant for the city of Grand Rapids, and the construction of the Cleveland & Eastern Railway at Cleveland, Ohio. This road runs from that point 36 miles east to Chardon, Ohio, being the second interurban line running out of Cleveland constructed by the Chase Company. They have also just completed and turned over to the owners quite an extensive lighting and power plant, operated by water power, at Belding, Mich., this being a high tension, multiphase alternating system.

PACIFIC COAST NOTES.

San Francisco, Cal., Sept. 4, 1899.

RENO, NEV.—The Electric Mining & Milling Company will erect a new smelter in Reno, Nev.

SALEM, ORE.—The Salem Light & Traction Company has had its contract ratified for lighting the streets of that city. The new contract, which will go into effect Sept. 10 next, calls for 35 arc lights, of 1200-cp each, at a cost of $2500 a year.

THE WILKINS AUTOMOBILE COMPANY has been incorporated, with San Francisco named as the principal place of business. Objects: To make and sell automobiles. Directors—J. M. Wilkins, Art. Wilkins, W. Neumann, Alfred Fuhrmann, and Robert Jorden, of San Francisco. Capital stock, $100,000.

MR. L. P. DREXLER, who died at his home in San Francisco, on Aug. 17, was the president of the Sacramento Electric, Gas & Railway Company, and was its heaviest bondholder. He was responsible for the reorganization of that company and the Folsom Power Company. His business judgment was always good and he did much to develop the natural resources of California. His age was 63 years, and he left a widow but no children. He had resided in California since 1854.

THE PACIFIC TELEPHONE & TELEGRAPH COMPANY made a novel and practical contribution to the fund for the recent reception of the California Volunteers in San Francisco. It installed a complete telephone system connecting the thirteen grand stands along the line of march with a "Central" office, installed in the Hearst Building. In this way the men who discharged the fireworks from the stands during the night parade were kept informed as to the progress of the parade and were thus enabled to give each division of the procession its proper proportion of pyrotechnics. The representative of the fireworks company also gave his directions to the operators from "Central."

THE THREE-DAY RECEPTION to the returning First California Volunteers from the Philippines was remarkable for the effective use of incandescent lights in decorating streets and public buildings. The large number and size of the buildings required careful management. Mr. E. H. Forst, as superintendent of lighting, carried out the committee's wishes very ably. The problems of illuminating the tower of the Ferry Depot and the great dome of the City Hall were successfully worked out. Market Street was illuminated for a distance of two miles with festoons of electric lamps 24 in a row. About 5000 lamps were so used. The City Hall dome, which is taller than that of St. Paul's, in London, required 3500 lights to outline it. On the tower of the ferry building 2000 lights were massed together. The current for these lamps was supplied by the San Francisco Gas & Electric Company. Within the ferry building were 1500 incandescent lamps arranged for decorative effect and operated by the Mutual Electric Light Company. For private electric displays and business houses, the stocks of all the San Francisco electric supply houses were cleaned out, and Los Angeles and other cities were appealed to for thousands of incandescent lamps. Refilled lamps, supplied by the Pacific Incandescent Lamp Company, were used for the public displays.

INDIANA NOTES.

Indianapolis, Sept. 9, 1899.

CHARITY CONDUCTORS.—Young women of New Albany served as conductors on the street railway lines of that city on the 30th ult. The companies contributed the proceeds to charity work.

HOME TELEPHONE COMPANY.—The citizens of Centerville are organizing a Home Telephone Company, and will construct a plant to be operated in connection with the Richmond Home Telephone Company.

SEEKING A LOCATION.—The Sterling Electric Company has made overtures to the citizens of Lafayette to locate and build a plant in that city, if a site be furnished. Efforts to raise the $10,000 necessary are being made with success.

TELEPHONE FRANCHISE GRANTED.—The city council of Kokomo has granted a telephone franchise to a local company, headed by J. F. Kerlin. The new rates are placed at $2 a month to business houses and $1 to residences. The Central Union, which claims a perpetual charter to operate in Kokomo, is threatening a war.

ABOUT TO QUIT THE FIELD.—The Mutual Telephone Company, doing business in Logansport, is about to quit the field. Inadequate support is given as a cause. The rates established at the inception of the undertaking were too low to maintain satisfactory service. It is thought the Bell Company will come into possession of the plant.

ELECTRIC LIGHT FRANCHISE GRANTED.—The council of the City of Plymouth granted, on the 29th ult., an electric light franchise for ten years to the Famous Electric Light Company of Chicago. The local electric light plant was the only competitor. The citizens have been in a fever heat over the matter for three months, as this virtually confiscates the old plant.

COVINGTON, IND.—The Covington & Coal Creek Co-operative Telephone Company filed articles of association with the Secretary of State during the week. The company is headed by A. P. Burnsides. The capital stock is $10,000. They will operate lines in Fountain, Warren, Vermillion, Park and Montgomery Counties, and their headquarters will be at Covington.

A PLANT PASSES TO THE BELL COMPANY.—The Independent Telephone Exchange plant of Elwood, owned by the Overshiners, will on the 1st of October pass to the control of the Bell Company. The Overshiner plant has been in operation about five years, and has kept rates down to $1 a month per telephone. An advance is anticipated with the opposition out of the way.

A PROPOSED ELECTRIC LINE.—A syndicate of Eastern and local capitalists purpose building an electric railway from Hartford City to Montpelier and thence to Camden, piercing the heart of the Indiana oil fields and eventually to be extended to the Van Buren field. A line is already constructed from Montpelier to Rustic Park, and only seven miles is necessary to connect Montpelier with the county seat.

DEFEATED A SUBSIDY.—At a popular election the proposed subsidy to the Kokomo, Wabash & Northern Electric Railway was defeated by the electors in the townships of Wabash County, through which it is to run. The promoters of the road are not discouraged, however, and will not abandon the enterprise, but endeavor to secure subscriptions to the stock sufficient to build the line. The rights-of-way have been secured.

A CONSOLIDATION SCHEME.—A firm of bond brokers at Indianapolis has got up a scheme to unite all the electric lines of the state in one great system, and make divisions of the branches. The firm have traveled over the various electric lines which they expect to interest, during the past week, having for their guests a party of capitalists who are taking interest in the scheme. It is understood that the owners of the Indianapolis Street Railway are interested in the scheme.

DEMAND FOR A RETURN TROLLEY WIRE.—Vice-President Davis, of the Indianapolis Water Works, is presenting to the Board of Public Works a lot of data which he has been collecting for some time past concerning the destructiveness of the electric current from the street railway lines on water mains and pipes. He will ask that the street railway company be compelled to put in a heavy return wire back to the station, instead of allowing it to ground on the water pipes, as at present.

STOCK OWNED BY FT. WAYNE MEN.—A deal was consummated on the 19th whereby all the stock of the National Telephone & Telegraph Company was purchased by Ft. Wayne men. S. M. Foster, C. S. Bash, H. C. Paul and G. W. Beers are the purchasers, and C. H. Cory, J. L. Duffield and Frank Holmes, of Lima, the sellers. The National Company was organized two years ago, and has built up a large business in operating toll lines in Ohio, Indiana and Michigan, connecting a large number of independent exchanges.

ADDITIONAL LINES FAVORABLY CONSIDERED.—It is currently reported in Northern Indiana that the Pennsylvania syndicate, which has a heavy investment in Northern Indiana lines, is favorably considering the construction of additional interurban lines, running between Coldwater, Mich., and Elkhart, Ind., via Bronson, Burr Oaks, Sturgis, Klinger Lake, White Pigeon, Mich., and Bristol, Md. These branches are to be built during the coming year. They also propose to build a line from South Bend, via Carlisle and Laporte, to establish lake connections at Michigan City harbor.

TO ENJOIN THE STATE TAX BOARD.—Several suits have been brought by railway companies against the State Tax Board to enjoin it from certifying to the Auditor of State the assessments placed against the roads by the State Board, and the Auditor from certifying the same to the several County Auditors. The complaint sets out that the roads are assessed at more than their cash value, whereas real estate is assessed at two-thirds value. Notices of appeal to the courts have also been given by a number of telephone, electric railway and gas companies. A temporary restraining order has been issued by the court.

General News.

THE TELEGRAPH AND TELEPHONE.

TERRILL, IOWA.—A telephone line is being built from Superior to Terrill.

KEYSER, W. VA.—The Union Telephone Exchange has been incorporated; capital, $50,000; shares $10 each. Attorney, George Davis, Keyser, W. Va.

AXTELL, NEB.—The Nebraska Telephone Company has completed its line to Axtell, and the town is now in communication with all points in the state.

BOWLING GREEN, OHIO.—The Bowling Green Telephone Company has been incorporated by James G. Hickox, Kennett V. Murray, L. B. Black, Frank A. Baldwin and Fred J. Bellmyer. The company is to connect Bowling Green with the other towns in that county, and the capital stock is fixed at $15,000.

CLEVELAND, OHIO.—The American District Telegraph Company, of Cleveland, has been incorporated with $100,000 capital stock. The company is to operate a general messenger delivery and district telegraph service. The incorporators are Herbert D. Bennett, Gansey R. Johnson, Harry M. Daugherty, W. W. Walker and William F. Burdell.

ST. LOUIS, MO.—Mr. H. J. Hanford, general manager of the Kinloch Telephone Company, is arranging a new long distance telephone, which is to cover all important points in the Mississippi Valley. The proposed company will be incorporated, with a capital stock of $1,000,000 paid up. It will be known as the Kinloch Long Distance Telephone Company, and will extend many miles to the north, east, south and west of St. Louis. The company is the outgrowth of the Kinloch Telephone Company, of St. Louis, which organization has recently made a large extension in its local service, involving an additional expenditure of $212,000 on its switchboard facilities.

ILLINOIS TELEPHONE CONDUITS.—A sharp investigation of the construction plans of the Illinois Telephone & Telegraph Company will be made by the Chicago Department of Public Works before conduit laying permits are granted. Last week President Albert G. Wheeler made formal application for consent to open the streets. In response Commissioner McGann directed a series of pointed questions, the most pertinent of which asks light on the necessity of a conduit four feet wide by seven feet high, the submitted plan of which does not specify at what depth it will be built. The question arises as to whether the Illinois Company, if its ordinance permits the building of a conduit of those dimensions, may not construct one of much greater size, with possibilities of utility far beyond the needs of mere telephone service. It is said the plans are "loopholed" to an extent that will enlist Commissioner McGann's closest scrutiny before the company is allowed to begin building operations.

KNOXVILLE, TENN.—Knoxville and Chattanooga capitalists will organize the Chattanooga Telephone Company, with $150,000 capital. It will operate an independent exchange in Chattanooga, in opposition to the East Tennessee Company, which operates under the Bell patents, and will also operate toll lines into North Georgia and connect with the East Tennessee lines of the People's Telephone Company, of this city.

THE ELECTRIC RAILWAY.

ST. LOUIS MO.—The St. Louis, Clayton & St. Charles Railway Company has been incorporated, with $50,000 capital stock, by J. H. Blessing and F. A. Huter, of St. Louis.

HAMILTON, OHIO.—The Hamilton & Lebanon Electric Railway Company has been incorporated, with $10,000 capital stock, by F. M. Hughes, J. C. Clawson and others, of Hamilton.

CORSICANA, TEXAS.—M. M. Bright and associates have been granted a liberal franchise for a trolley line in this city. They intend to build about nine miles of road and work has commenced.

NEW CASTLE, DEL.—A charter has been granted to the New Castle & Delaware City Trolley Company, with a capital of $100,000, to build a trolley line between those two points in this county.

DOVER, DEL.—The Philadelphia syndicate, which plans to build a trolley line in Kent County, has now formally applied for a charter under the name of the Delaware General Electric Company. The capital will be $1,000,000.

PEMBROKE, MASS.—The Pembroke Street Railway Company has been organized by John P. Morse, Brockton, Mass.; W. C. Forbes, Milton, Mass., and others, with a capital stock of $20,000, to build from Pembroke to Kingston.

AIKEN, S. C.—The Aiken & Augusta Electric Power Company has been organized by Charles W. Davis, Graniteville, S. C.; J. W. Ashurst, Aiken, and others, with $20,000 capital stock, to construct an electric railway from Aiken to Augusta.

STATEN ISLAND, N. Y.—The State Board of Railroad Commissioners has granted permission to the Staten Island Rapid Transit Railway Company to issue a second mortgage of $2,500,000 for the purpose of carrying out the scheme of reorganization of the property.

ATLANTA, GA.—The Atlanta & Roswell Electric Railway & Power Company is about to be incorporated with $500,000 capital stock, to construct a line from Atlanta to Buckhead, Roswell and Dunwoody, 25 miles. H. L. McKee, S. Y. Stribbling and C. W. Ansley are interested.

OWENSBORO, KY.—The Owensboro & Calhoun Interurban Railway Company has been incorporated, with $250,000 capital, to build from Owensboro to Calhoun, about 25 miles. The officers are J. H. Hickman, president; J. D. Fredd, vice-president and general manager; J. T. Griffith, treasurer.

DECATUR, ILL.—The property of the City Electric Street Railway Company has been sold by the Master in Chancery to David S. Shellabarger, for $120,500. The road was bonded for $175,000. The defaulted interest amounts to about $20,000. A large sum will be necessary to put the line in good shape.

WILMINGTON, DEL.—A syndicate in which J. Edward Addicks, his state chairman, J. Frank Allee, and John D. Hawkins are interested has been balked by the Kent County Levy Court in an attempt to prevent the recently formed Delaware General Electric Company from securing permission to build a trolley road through the principal towns of Kent County.

BIRMINGHAM, ALA.—In the United States Court Clerk N. W. Trimble has made a deed of the Highland Avenue & Belt Railroad to Elmer E. Whitaker, of New York, for a consideration of $176,000. This property was sold at a receiver's sale in July, but the sale was contested. Circuit Judge Shelby, however, confirmed the sale and ordered the deed made. Mr. Whitaker represents James T. Woodward, of the Hanover National Bank, and other eastern people.

NEWARK, OHIO.—The Newark & Granville Consolidated Street Railway has been sold by Receiver James F. Lingafelter, in pursuance of an order of the Common Pleas Court. There was but one bidder present, the Equitable Trust Company, of Chicago. This company is trustee for the mortgaged bonds issued by the railway company. The bid was made by the Equitable Trust Company according to an agreement entered into by all parties to the case. The road was sold for $160,400, which was two-thirds of the appraised value.

TOLEDO TO BUFFALO.—H. A. Haigh and S. S. Angus, of Detroit, have completed arrangements for an electric road from Toledo to Buffalo. It will be the longest road of its kind in the world. The material is now on the ground for the construction of the line from Toledo to Norwalk, and this will be running by Dec. 1. Mr. Haigh has stated that the road would be pushed through to Cleveland, and that connections with other electric lines would carry the road to Buffalo. The new system will be in running order by the middle of June next year. In connection with this great through line, spurs will be put out in many directions. The promoters are now securing rights of way for a number of feeding lines to be constructed in this state.

NEWARK, N. J.—The proposed trolley passenger and freight line between Newark and Lake Hopatcong, a distance of 30 miles, over a grade of 2 per cent., is assured. The road will be built and equipped by Aug. 1, 1900, with double tracks and stations in all important towns and villages, including Montclair, Boonton, Whippany, Caldwell, Parsippany, Dover, Denville, Rockaway and Morristown. Freight cars will not be combined with the passenger service, but special freight trains will be run. The right of way obtained is 100 feet wide the entire distance The power plant will be situated half way between the two ends. It is calculated to make high speed through the route. Eight-wheeled cars will be used, and large motors will be placed in each car. The freight cars will be supplied with 100-hp motors. It is expected the passenger fare will be 1 cent per mile.

ELECTRIC LIGHT AND POWER.

CORALVILLE, IOWA.—The $25,000 electric light plant at Coralville has been completed.

WAUPUN, WIS.—Contract for an electric plant has been let to Rockwell & Snider, of Chicago, at $10,559.

KENOSHA, WIS.—The Kenosha Light & Power Company proposes to improve its plant at a cost of $30,000.

PLYMOUTH, IND.—The electric franchise for 10 years has been awarded to the Famous Electric Light Company, of Chicago.

LOUISVILLE, ILL.—The contract for a lighting plant and water works has been let to Reed & Searles, of Chicago, Ill., at $11,500.

MILTON, N. H.—The Milton Water & Power Company has been formed by S. Lyman, president; H. L. Avery, secretary and treasurer.

PROVIDENCE, R. I.—The New England Lighting Company has been formed, capital, $100,000, by C. T. Daniels, C. A. Babcock.

PIERRE, S. D.—The Empire Light Company has been formed, capital $100,000, by E. L. Squire, George E. Spencer and L. C. Smith.

BENNETTSVILLE, S. C.—The Bennettsville Light & Power Company has been formed, capital $5000, by T. W. Bouchier and H. L. McCall.

ELIZABETHTOWN, KY.—The Elizabethtown Electric Light Company has been formed, capital $5000, by David L. May and W. C. Montgomery.

RICHWOOD, OHIO.—The Richwood Light, Heat & Power Company has been formed. Capital, $5000. G. M. Schambs, M. C. Wolgamot, J. F. Millen.

STILLWATER, N. Y.—The Half Moon Light, Heat & Power Company has been formed, capital $20,000, by F. H. Ferris, J. C. Duncan, Mechanicsville, N. Y.

DOWNER'S GROVE, ILL.—The village board has let the contract for a plant to E. H. Prince. The plant will be operated in connection with the water works.

DOVER, DEL.—A charter has been granted at Dover to the Boston & Joplin Heat & Light Company of Boston, with a capital of $100,000, to engage in electric heating.

BLOOMBURG, PA.—The American Electric Light Company has been formed, capital $90,000, by G. Pelton, Scranton; G. W. Reynolds, Wilkesbarre; P. R. Bevan, Carbondale, Pa.

ASHLEY, IND.—The electric light plant at Ashley was completely destroyed by a boiler explosion, which injured several people. The plant is a total wreck, the loss being estimated at $10,000.

WOODBURY, N. J.—The Woodbury Ice & Power Company has been formed, capital $50,000, by Job Scott, Mantua, N. J.; Daniel V. Somerville, Jr., Pennsgrove, N. J.; Samuel L. Franklin, Woodbury, N. J.

SPRING VALLEY, ILL.—The Spring Valley Electric Light Co. has placed an order with the Royal Electric Company, of Peoria, Ill., for an alternating current generator, a Corliss engine, and switchboard transformers, etc.

LOUISVILLE, KY.—The Cumberland Falls Company has been formed. Capital, $90,000; to build a power plant at Cumberland Falls, Whitley County; C. W. Banta, president; Louis H. Morgan, treasurer; James C. Allin, secretary.

NIAGARA FALLS, N. Y.—During the International Exposition to be held at Buffalo the Niagara Falls will be illuminated by huge electric searchlights, equipped with multicolored glasses, and arc lights will be operated in the Cave of the Winds.

DOVER, DEL.—The Boston Industrial Company, with a capital of $100,000, has been incorporated at Dover. It purposes to construct, own and operate plants for the manufacture of water, gas, electrical works and electric railways outside of the state.

TRENTON, N. J.—The Southern Light & Traction Company, with an authorized capital stock of $2,500,000, has been incorporated here. The company's charter provides that it may acquire bonds, mortgages and capital stock of other companies. The incorporators are Charles N. King, N. R. Vanderhoff and Augustus C. Kellogg, all of Jersey City.

WINCHESTER, VA.—The city council has awarded the Winchester Gas & Electric Light Company a five-year contract for lighting the city with electricity. The price per lamp is $55 per annum. Under the contract the company is to put in an entirely new plant within 90 days and is to have in operation an incandescent system for private service. The improvements will cost about $8000.

ALTOONA, PA.—A quiet struggle for the possession of the Edison electric light plant, which has a monopoly of the business in Altoona, has terminated in favor of Philadelphians interested in the Electric Company of America. Colonel A. Loudon Snowden and William J. Latta are the heaviest purchasers of the Altoona concern. The stock is worth $50 at par, but it brought $95, the deal aggregating $223,000.

THE AUTOMOBILE.

DENVER, COLO.—The Western Automobile Company has been formed; capital, $10,000. Incorporators, G. T. Emerson, W. A. Perry, M. Edgar, G. T. Schackelford, all of Denver.

CLEVELAND, OHIO.—The Twentieth Century Automobile Company, of Cleveland, has been incorporated with the secretary of state for $10,000. The new concern has for its object "the carrying of the public in the streets of Cleveland and vicinity with automobiles."

MILWAUKEE, WIS.—The United States Automobile Company, of Milwaukee, has been organized. Besides making automobiles the company will manufacture rotary engines and gasoline motors. The capital stock is $500,000. C. B. Thomson & Co. and Charles Scholl are promoting the enterprise.

NEWARK, N. J.—Several capitalists have organized a company in this city to operate automobiles under Electric Vehicle Company's license. James E. Hayes, is president of the company, and J. H. Ballantine, the brewer, and J. M. Quinby & Co. are interested in the scheme. The company will do a livery and delivery business.

NEW YORK, N. Y.—A new motor carriage company is in process of formation. It will be incorporated in New Jersey, with a capital stock of $250,000. It is being formed to manufacture trucks, delivery wagons and carriages, with appliances patented and invented by J. W. Walters, of this city. A feature introduced in the Walters vehicle is that it will have only three wheels instead of four.

MR. GEORGE H. CORNELL, formerly chief engineer of the Brooklyn Elevated Railroad, has sailed for Europe to attend the automobile exhibition at Berlin. Mr. Cornell goes abroad, it is said, as the representative of a newly organized automobile company in Brooklyn. He is to gather ideas as to the manufacture of the machines, which the Brooklyn concern purposes to utilize in its productions.

LOS ANGELES, CAL.—It is contemplated in the near future to establish a factory here for the manufacture of automobiles on a large scale. The motor trap now on exhibition in this city was made by the Duryea Manufacturing Company, of Peoria, Ill. Mr. Henderson, who has secured the agency for the coast, has organized a corporation called the Henderson Horseless Carriage Company, and will, as soon as practicable, establish a factory in Los Angeles for the manufacture of these automobiles, which will include everything from the light pleasure trap to the heaviest truck.

OBITUARY.

GASTON TISSANDIER.—With deep regret we note that M. Gaston Tissandier, the distinguished French chemist and aeronaut, died in France on Sept. 8, in his fifty-sixth year. He was born in Paris, Nov. 21, 1843. After following the course at the Lycee Bonaparte, he devoted himself to chemistry, and was admitted to one of the laboratories of the Conservatory of Arts. In 1864 he became Director of the Laboratory of Experiment and Analysis. For a time he occupied himself with meteorological investigations, and in August, 1868, he made his first balloon ascension from Calais, venturing out over the ocean, and returning with the aid of a lower current moving in the opposite direction. Thereafter he made 24 aerial voyages, sometimes alone, sometimes with his brother, with whom he escaped in a balloon from Paris at the time of the siege. On the occasion of his second ascension in the Zenith, in April, 1875, the altitude attained, 8600 metres, proved fatal to his companion. His repeated ascensions were not without substantial scientific results. He submitted to the Academy of Sciences numerous essays and narratives of his observations. Among his better known works are "In a Balloon; The Souvenirs of an Aeronaut;" "The Application of Electricity to Aerial Navigation," and "Photography in a Balloon." His editorial connection with *La Nature*, an admirable French scientific publication, has lasted for some years.

MR. J. H. SESSIONS.—Mr. John H. Sessions, president of the Sessions Foundry Company, died at his home, Bristol, Conn., on Sept. 10, from Bright's disease, aged 71 years. He was president of the Bristol National Bank and the Bristol Water Company; director in the Bristol & Plainville Tramway Company, and trustee of Wesleyan University and Wilbraham Academy. Under his management the Foundry Company had achieved a very high reputation for its work.

PERSONAL.

MR. C. P. ADAMS, superintendent of telegraph of the Great Northern Railway, has resigned and accepted the office of superintendent of telegraph of the New Jersey Central.

MESSRS. H. WHITLEY and H. F. Street, electrical engineers connected with the lighting and street railway work at Halifax, England, are in this country making a study of American electrical conditions and methods. Halifax is a city of heavy grades and is going in for trolley roads. Mr. Street, as borough electrical engineer, is supplying about 35,000 light capacity.

MR. J. J. SWANN, who is well known in electrical circles by his excellent journalistic work on electrical topics in the *Engineering News*, has associated himself with the Ingersoll-Sergeant Drill Company, of this city. His work will be in connection with their exhibit at the Paris Exposition, and he expects to leave for Paris some time in December.

MR. W. J. JOHNSTON, late publisher of the *Electrical World*, arrived at the Hawaiian stage of his journey around the world Aug. 23, and was to remain in Honolulu until Sept. 9. In an interview with a local reporter, Mr. Johnston said that he never enjoyed a trip more than the one from San Francisco to Honolulu, having found the "Hongkong Maru" one of the most comfortable and most seaworthy vessels afloat, while the table and the service throughout the ship were excellent in every respect.

SIGNOR MARCONI sailed for this country on Wednesday, leaving others to conduct the experiments before the British Association and describe what he has done with wireless telegraphy. Several instruments have been put in order at the South Foreland station for exhibition here. He expects Americans to take a hearty interest in his wireless system. During the Dover meeting of the British Association there will be constant communication without wires between the town hall and three stations, namely, Boulogne, East Goodwin Lightship and South Foreland.

MR. GUIDO SEMENZA, chief engineer of the Milan (Italy) central stations, is on a visit to this country and will attend the Edison convention in Philadelphia during the current week. His company is about to build extensive additions to its stations and system, and some of the apparatus will be obtained in this country.

MR. GEORGE HARVEY SEWARD, in charge of the Publication Bureau of the Crocker-Wheeler Company, at Ampere, N. J., has gone to Rochester, N. Y., to accept a position with the Bausch & Lomb Optical Company, in the same line of work. In making this engagement, he re-enters the optical and photographic field. Mr. Seward is a graduate from the Sheffield Scientific School. This and his practical experience has eminently fitted him for his special work. He was in the employ of the Short Electric Company, on street railway construction; with the Sargent Manufacturing Company, New Haven, Conn., and the Mergenthaler Linotype Company, of Brooklyn, N. Y., as draughtsman, and with J. B. Colt & Co., lantern manufacturers, and the F. A. Ringler Company, of this city, on advertising, engraving and photographic work. Mr. Seward has now been engaged to work up the Bausch-Lomb catalogues, which are necessarily highly technical and deal with every branch of optics and many physical lines. He will also be associated with Mr. L. B. Elliott, editor of *Journal of Applied Microscopy*, issued from the publication department of the firm.

Trade and Industrial Notes.

STILWELL-BIERCE & SMITH-VAILE COMPANY, of Dayton, O., have established a branch office for St. Louis and contiguous territory in the Burlington Building, Room 601, that city, and have made Mr. Louis Bendit its manager.

THE ELECTRIC APPLIANCE COMPANY, Chicago, are Western selling agents for the Two-Ball Cord Adjuster or Incandescent Lamp Hanger. They state that for the past year each month's sales of this adjuster have shown an increase over that of the previous month.

SCHUMACHER & BOYE have succeeded to the business of Dietz, Schumacher & Boye, of Cincinnati, makers of high grade machine tools, etc., Mr. Jacob Dietz, of the latter firm, having retired Sept. 1. The new firm assumes all indebtedness of the old firm of Dietz, Schumacher & Boye, and will receive all money owing to its predecessor.

THE CENTRAL ELECTRIC COMPANY, Chicago, are naming special and attractive prices on a small line, in few sizes, of their Central 1899 fan motors. On these few sizes this firm overestimated the demand, and the prices to close out are such as to make purchasing an excellent investment for use of the Central fan motors during the following seasons.

HARE'S COMMUTATOR COMPOUND, made by Southworth & Hare, Indianapolis, is proving a popular remedy for all diseases of commutators. It is said to be successful in the most severe cases of sparking and wear. The manufacturers want all users of dynamos to write for samples, and will furnish expert advice on all commutator troubles free of charge.

THE KOKOMO TELEPHONE MANUFACTURING COMPANY, Kokomo, Ind., has issued a neatly printed 26-page catalogue illustrating and describing the different types of telephones, switchboards and telephone apparatus of its manufacture. The final pages of the book contain a number of commendatory letters from purchasers of Kokomo apparatus.

NEWGARD RECEPTACLE AND GLOBE.—A recent circular by the Electric Appliance Company illustrates the several types of Newgard receptacle and globe. Unlike the older forms of this type of appliance, the Newgard is absolutely waterproof, the construction being such as to thoroughly seal the union of the guard and receptacle and the conducting wires.

MR. EDWARD S. HALSEY, who is introducing his maximum recorder, or discount attachment for integrating wattmeters, has moved into new, spacious quarters at Rooms 1501 and 1502 Manhattan Building, Chicago. He is now in a position to fill orders promptly, and states that he would like to equip trial meters for those contemplating the adoption of the discount system, based upon the maximum demand.

ELECTRICITY FOR MACHINE DRIVING.—In a handsome pamphlet the Westinghouse Electric & Manufacturing Company point out in a brief manner a few of the many advantages of the electric current for various power distribution in manufactories. Actual applications of polyphase motors to machine tools are shown in a number of illustrations, which, in execution, are beautiful specimens of the engraver's art.

M. C. BULLOCK COMPANY CATALOGUE.—We are in receipt from the M. C. Bullock Manufacturing Company, of Chicago, of "The Diamond Drill," a comprehensive 80-page catalogue. It describes the uses of the diamond drill and points out the general features of the Bullock drills and their many points of merit, such as the compact, balanced engines, the patent swivel head, etc. The catalogue contains bits, etc., and a lot of information on costs of drilling, etc., together with numerous testimonials. There is much data that is valuable to electrical engineers in it.

CHLORIDE STORAGE BATTERIES.—Circular No. 53, of the Electric Storage Battery Company, describes an installation of storage batteries in a large New York City apartment house. The battery and booster are illustrated, the former consisting of 60 cells of a discharge rate of 15 amperes for 12 hours. The house contains 1200 lights and an electric elevator. A load curve illustrates the extreme variations of load imposed by the latter, which are taken care of by the battery, which also permitted reducing the daily run of the dynamo from 20 to 8 hours daily.

WESTINGHOUSE GAS ENGINE.—A useful addition to the literature of the gas engine has just been made in the form of a pamphlet issued by the Westinghouse Machine Company, describing the Westinghouse gas engine. Though professedly a trade publication, we know of no treatise on the gas engine from which a better idea may be obtained of the principles in general involved in that type of heat engine. In addition, the pamphlet is a beautiful specimen of printing and engraving. The descriptive matter, which is very well written, is accompanied by more than a score of well executed engravings which illustrate every detail of the engine. The final pages are devoted to an interesting discussion of the comparative commercial economy of gas and steam engines.

THE WESTERN ELECTRICAL SUPPLY COMPANY, of St. Louis, report that their fall trade has opened up better than ever before in the history of their business. The sales of their Monarch lamp have been especially flattering. They have gradually improved this lamp, until to-day they claim it to be the equal of any incandescent lamp made. They guarantee it to be absolutely true as to candle power and current consumption. Their Moloney transformer has established itself brillianly on the market. They claim no transformer has as close regulation and high efficiency as it has, that no expense has been spared in its construction, and that both workmanship and material are the best that can be had. As an evidence of this, they are willing to guarantee it for two years.

THE BURNLEY BATTERY MANUFACTURING COMPANY, of Painesville, Ohio, announces that its sales on batteries and soldering paste are nearly 100 per cent. more than the year previous, and, judging from the past, the outlook for the future is very promising. In order that the trade may be duly informed as to the patent situation on soldering paste, they ask us to insert one of the patent claims which reads as follows: "A plastic flux or soldering paste for use in joining bodies of metal with solder, the same consisting of a flux in solution mixed with a fat or grease that is pasty at ordinary temperatures." The application was filed June 3, 1895. Patent No. 608,978 reveals two more claims covering the ground fully.

TWENTY-TWO YEARS' USE.—Under the title of "Twenty-two Years' Use of Electrical Apparatus," Mr. S. M. Hamill has issued on behalf of the General Electric Company a very tasteful and striking pamphlet devoted to the subject of the Brush apparatus, to the manufacture and marketing of which he has given so many successful years. It is wonderful how the good old Brush machines stand the racket of time and of wear and tear. As Mr. Hamill remarks: "There are a large number of arc generators throughout the world that have been running for upwards of twenty years, and are in use to-day. This is an indication of what good apparatus will do when well cared for. Good apparatus carelessly operated will not run for twenty years. Poor apparatus carefully operated will not run for twenty years. But good apparatus carefully handled will, and for how many years in addition I am unable to state." The dainty brochure makes good reading.

COLOR UNDER ELECTRIC LIGHT.—A prominent American artist, who has made a great many experiments in lighting paintings with incandescent light, claims that it is not the quality of the light, but its quantity, that affects the color values. Yellows, for instance, which under ordinary light are almost white, retain their true value under a strong and evenly diffused light. This theory is substantiated by the experience of I. P. Frink in lighting paintings in the large art galleries, and his application of the same principles to store window lighting gives merchants practically the daylight colors of their goods at night. This is especially important to dry goods houses, for their windows are filled with daintily colored dress fabrics, which attract attention primarily by their colors. Under ordinary light, some colors look washed out, while others are accentuated. Frink's patent window reflector gives a very strong and evenly diffused light, yet no lamp is in view to distract the eye by its concentrated brilliancy; and under this light color values hold their own in a way that is surprising. Now that so many new stores are being rushed to completion to be ready for the winter trade, and so many enterprising merchants are on the lookout for anything that will enhance the appearance of their stock, contracting engineers will find it easy to secure orders for the installation of this fixture. Mr. Frink reports that his best customers are those who have had several installations of the fixture, and from these he has received the most flattering testimonials as to its success and the satisfaction it gives their customers. Estimates can be promptly obtained by sending dimensions of the windows of I. P. Frink, 551 Pearl Street, New York.

SALES OF TRIUMPH APPARATUS.—During the month of August the Triumph Electric Company, of Cincinnati, booked orders for over 150 machines. Among the orders were the following: Of belted generators shipments were made of one 150-kw generator to Burgess Iron & Steel Company, Portsmouth, Ohio; two 100-kw generators to the Luhrig Coal Company, Athens, Ohio; one 35-kw generator to the Gates Elevator & Mills, Cleveland, Ohio; one 25-kw to George D. Sheer, Cleveland, Ohio; one 80-kw to the Cincinnati Coffin Company, Cincinnati, Ohio; one 125-kw to the Ottawa Street Railway Company, Ottawa, Ill.; one 25-kw generator to Schureman & Hayden, Chicago; one of 17½-kw to Potter Wall Paper Company, Chicago, Ill.; one of 25-kw to J. P. Smith Shoe Company, Chicago; one 100-kw to Grand Island Electric Light Company, Grand Island, Neb.; one 25-kw to Genoa Indian School, Genoa, Neb.; one 50-kw generator to the Carlisle Electric Light Co., Carlisle, Ky.; one 35-kw generator to Murray Electric Light Company, Murray, Ky.; one 25-kw to the Owingsville Electric Light Company, Owingsville, Ky.; one of 80-kw to the Light, Heat & Power Company, New Albany, Ind.; one of 17½-kw to A. E. Rose, Decatur, Ind.; one 25-kw generator to the Star Piano Company, Richmond, Ind.; one 17½-kw generator to Walsh Distillery, Lawrenceburg, Ind.; one of 25-kw to the Arcadia Electric Light Company, Arcadia, Ind.; two 25-kw generators to the Fargo Gas & Electric Light Company, Fargo, N. D.; one 25-kw to the Kanawha Electric Company, Montgomery, W. Va.; one 25-kw to J. C. Fredlock, Piedmont, W. Va.; one 25-kw to Williamson Electric Light Company, Williamson, W. Va.; one 60-kw to R. & H. Simon Silk Company, Union Hill, N. Y.; one 17½-kw to Bonner Bros., Brooklyn, N. Y.; one 17½-kw to the Congress Brewing Company, Brooklyn, N. Y.; two 17½-kw generators to Lee Line, Memphis, Tenn. Direct-connected generators were shipped as follows: Three 30-kw generators to the Western Reserve Building, Cleveland, Ohio; one 50-kw generator to the Globe Company, Cincinnati, Ohio; one 150-kw to Braun & Fitts, Chicago; one 62½-kw to Albert Schwill & Co., Chicago; one 75-kw to the Reform School, Lexington, Ky.; one 50-kw to the Court House, Lexington, Ky.; one 30-kw to the Court House, Lexington, Ky.; one 50-kw generator to the City of Larimore, Larimore, N. D.;

one 15-kw generator to the Northern Alabama Coal & Iron Company, Talladega, Ala.; one 30-kw to Vertin Bros., Calumet, Mich.; two 30-kw generators to Trorlicht Duncker & Renard Carpet Company, St. Louis, Mo.; one of 20-kw to the Methodist Publishing Company, Nashville, Tenn. The shipment of motors was as follows: One 25-hp motor to J. A. Fay & Co., Cincinnati, Ohio; one of 15-hp, one of 10-hp, one of 3½-hp and two of 2-hp to the Cincinnati Coffin Company, Cincinnati, Ohio; one 30-hp and two 10-hp motors to Albert Schwill & Co., Chicago; four motors to R. & H. Simon Silk Company, Union Hill, N. Y.; two motors to the Congress Brewing Company, Brooklyn, N. Y., and five motors to Armour & Co., Chicago.

Record of Electrical Patents.

UNITED STATES PATENTS, ISSUED SEPT. 5, 1899.

[In Charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

632,252. RAIL BOND FOR ELECTRIC RAILWAYS; F. H. Daniels, Worcester, Mass. App. filed June 7, 1899. This bond is a wire rope in the form of a loop provided with terminals, the sides of the loop being brought together at one point, but separated at other points to admit the bolts which hold the rails.

632,272. TROLLEY CATCHER; P. D. Milloy, Buffalo, N. Y. App. filed April 29, 1899. The trolley rope passes over a spring-actuated drum so constructed that slack in the rope will be taken up, and a gentle rise of the trolley will be permitted by letting out the rope while a quick rise will be prevented.

632,296. TELEPHONE SWITCHBOARD AND CIRCUIT; T. C. Wales, Jr., and K. W. Waterson, of Newton and Lowell, Mass. App. filed June 6, 1899. A system of circuits and connections for private exchanges whereby all the advantages of the common battery switchboard are obtained.

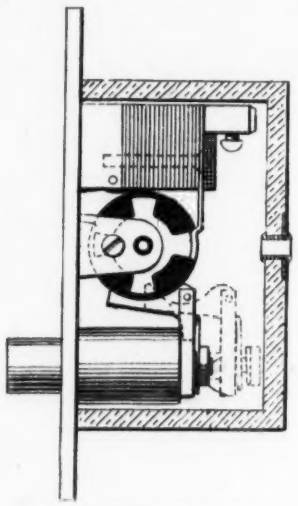
632,316. ELECTROMAGNETIC BATTERY; C. G. Marius, West Hoboken, N. J. App. filed July 7, 1899. The device is in the form of a roller for massage treatment, and contains a battery, induction coil and a pair of electrodes, the latter fitting around the exterior of the roller.

632,346. INSULATING RECEPTACLE FOR ELECTRIC SWITCHES; J. S. Gibbs, Hartford, Conn. App. filed May 9, 1899. The receptacle is constructed particularly to facilitate wiring and the manipulation and bending of the circuit wires as they are led to the switch connections.

632,353. TRAVELER FOR PIPES OR CONDUITS; L. C. Kohler, Milwaukee, Wis. App. filed Nov. 21, 1898. This is a mechanical traveler provided with gripping devices which are caused to vibrate against the wall of the conduit and force the traveler along, by means of a cord manipulated by hand from an opening in the conduit.

632,355. TELEPHONE TRANSMITTER; T. Lidberg, Chicago, Ill. App. filed Dec. 27, 1898. The diaphragm is uniformly held around its edges and is pressed upon between its edges and centre by springs which maintain a stress on the plate. The idea is to make the instrument more sensitive.

632,357. CIRCUIT CONTROLLER; A. Lungen, New York. App. filed June 13, 1899. The device is adapted to be inserted into the jamb of a door for the purpose of controlling a light in a telephone booth or similar place. The movement of the door for the entrance and exit of a person causes the light to burn while the person is in the booth, and be extinguished when he leaves the booth.



632,357.—Circuit Controller.

632,380. TROLLEY WHEEL; E. R. Stillman, Dayton, Ohio. App. filed Oct. 24, 1898. The wheel has a central threaded bore in which fits a bushing having a large chamber communicating with the axle through small ports. The chamber contains lubricating material.

632,421. MEANS FOR GENERATING ELECTRICITY FROM CAR WHEEL AXLES; M Moskowitz, Newark, N. J. App. filed Aug. 3, 1898. This invention provides for rigidly mounting the dynamo on the truck and driving it by frictional contact between pulleys, the construction being such that inequalities in the roadbed and variations of weight on the car will not alter the frictional engagement.

632,512. ELECTRIC BURGLAR ALARM; Clyde Coleman, of Chicago, Ill. App. filed Sept. 28, 1896. Relates to a system in which there is a local alarm circuit controlled by a main current; a device is related to said circuit so as to be influenced by variations of electrical conditions in the main circuits, and thereby give a signal. The amount of resistance in the main circuit, considered in its entirety, remains constant, the resistance in local portions being varied from time to time. A construction of rheostat is described for use more particularly in this system.

632,513. ELECTRICAL BURGLAR ALARM SYSTEM; Clyde Coleman, of Chicago, Ill. App. filed Oct. 22, 1897. Relates in part to the class of burglar alarm systems in which the alarm devices are disposed in a housing electrically protected by an electrical barrier which in normal condition prevents access to the interior of the housing without causing an alarm to be given. Means are provided whereby the alarm mechanism may be controlled and kept in normal condition by means of a current which takes a circuit that does not include the door contacts of the protected housing, so that after this control of the alarm mechanism through this auxiliary circuit is established, the door of the protected housing may be opened without causing an alarm.

632,514. ELECTRIC CABLE; Clyde Coleman, of Chicago, Ill. App. filed Oct. 22, 1897. The cable consists of one or more straight insulated conductors, a plurality of insulated conductors braided about the core, a jacket woven tightly about the braided conductors, and an outer sheathing of lead, the space between the jacket and sheathing being filled with paraffin or other wax.

632,516. CIRCUIT BREAKER FOR CONTROLLERS; W. H. Conrad, Philadelphia, Pa. App. filed May 17, 1899. A novel construction of trigger and latch operated electromagnetically to break the circuit upon the flow of an excessive current.

632,522. GAS LIGHTING APPLIANCE; A. Frank, New York. App. filed May 3, 1898. Improvements upon the device shown in United States patent No. 571,288.

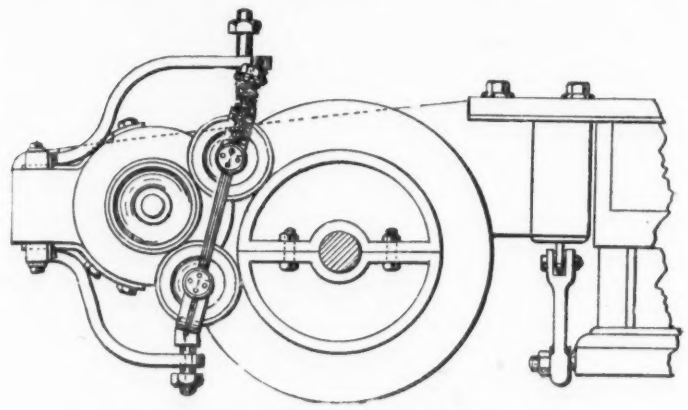
632,252.—Rail Bond.

632,543. SYSTEM OF ELECTRIC TRACTION; Edouard Verdovelli, of Paris, France. App. filed May 29, 1897. Metal blocks are arranged between the rails at short intervals, with which contact is made by a contact bar on the car. Below each block is a case containing a switch closing two upper or two lower contacts, the switch being operated by an electromagnet. A wire from the electromagnet in one case connects with a lower contact in the case beyond. Normally, the other lower contact being grounded, one of the upper contacts is connected to the block, and the other with the source of current. Normally the switch closes the lower contacts, but when the car passes over the adjacent block, the electromagnet is energized, the switch is raised and closes the circuit between the block and source of current; the switch in being raised, breaks the ground connection of the adjacent electromagnet, which causes the switch to resume its normal position.

632,546. MEANS OF GIVING ALARMS THROUGH AGENCY OF SMOKE OR OTHER GASES; Henry C. Baer, of New York, N. Y. App. filed Nov. 5, 1898. (See Current News and Notes.)

632,559. ELECTROMEDICAL APPLIANCE; J. A. Freeman, Dyer, Ky. App. filed May 10, 1899. An electric belt having attachments for treating various parts of the body.

632,667. MAGNETO ELECTRIC GENERATOR; J. A. Williams, Cleveland. Ohio. App. filed June 10, 1898. Contact plates are interposed between the pole-pieces and the magnets, which plates have sections engaging the magnets and other sections engaging the pole-pieces for the purpose of establishing good contact between the magnets and pole-pieces.



632,421 —Generating Current from Car Wheel Axles.

632,586. AUTOMATIC CODE TELEGRAPH FIRE ALARM; R. Pearson, London, England. App. filed Dec. 7, 1898. By this invention the entire alarm mechanisms upon the same main circuit can be separately tested by momentarily closing the testing circuit at a station.